Plan Requirement Guidance for Quartz Mining Projects

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Energy, Mines and Resources

Executive Summary

A quartz mining project requires the submission of environmental protection plans and operational plans for the development, operation, and decommissioning of a mine site. These plans will describe how mining activities will be undertaken, and how they will be completed in an environmentally responsible manner. This guide is intended to assist proponents with the development of the required Plans for quartz mining projects. These plans should be considered as living, dynamic documents that will be refined throughout mine planning, development and operation as more information certainty becomes available, and as monitoring, research, analysis and design are advanced.

Mining projects in Yukon usually require both a Quartz Mining License (QML) and a Water Licence (WL). Each license will consider and address mine development and operation plans and environmental protection plans. Mine development and operation activities are inherently integrated across all environmental disciplines and regulatory requirements. Therefore, this Guide describes requirements for the required plans to meet the needs for both QML and WL processes.

This guide provides overall guidance about expected contents of environmental and operational plans. This approach is intended to provide flexibility for proponents to identify and optimize plans to suit specific sites and project elements.

The specific information requirements described in this guide are intended to establish a framework for preparation of the required plans. They should not be considered all-inclusive and the contents of the guide should be interpreted and applied along with other important sources of information including ongoing discussions with governments, communities and regulatory agencies.

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1.0 Purpose and Objectives

The purpose of this guide is to assist mining proponents in preparing environmental and operational plans that achieve the requirements and expectations for plans submitted in accordance with Quartz Mine License (a "QML") and Water Licence (a "WL") processes. This guide provides the generic requirements for environmental and operational plans for a Quartz Mine (i.e., a hardrock mine), it should not be considered an exhaustive list of all requirements nor should its contents be considered absolute. Certain plans or components may not be appropriate for all mine sites, for example, a heap leach mine would not need to submit a tailings plan.

To achieve its purpose, the guide has the following objectives:

- To describe the information requirements and expectations for environmental protection plans, and mine operation plans; and
- To identify key sources of additional guidance for preparing the required plans.

2.0 Regulatory Context

Quartz mining projects in Yukon usually require both a Quartz Mining License issued by Yukon's Department of Energy Mines and Resources under the *Quartz Mining Act* and a Water Licence issued by the Yukon Water Board under the *Waters Act*.

With respect to QMLs, this guide applies within the context of the "Quartz Mining License Application Guide" (Energy Mines and Resources, February 2010) which describes the Quartz Mine License application procedures, the sequencing of approvals, and the plans required for a QML. In some cases QMLs may be issued in a staged approach to allow certain works on site to take place before the development of detailed plans for the mine site. Plans must be updated as site conditions change, as detailed designs are developed and when new activities are introduced.

With respect to WLs, this guide supplements the guidance provided in "Type A and B Quartz Mining Undertakings, Information Package for Applicants" (Yukon Water Board, February 2012). The "Information Package for Applicants" describes licence conditions that may be applied in WLs.

This guide describes the minimum requirements that must be included in the required environmental and operational plans. Additional components may be required as a result of an environmental assessment or as a result of applications for or permits issued under the *Waters Act*, the *Environment Act*, the *Quartz Mining Act*, the *Public Health and Safety Act,* or any other applicable federal and territorial acts.

3.0 Guidance, Best Management Practices and Policy Documents

The following references are to policies, guidelines, codes, manuals, etc., that have been accepted by Energy, Mines and Resources as providing approaches and directions that will be relied upon in reviewing environmental and operational plans.

Applicants are urged to refer to and utilize these documents where appropriate when preparing plans for submission.

- Canadian Dam Association. Dam Safety Guidelines.
- Canadian Council of Ministers of the Environment. Canadian Water Quality Guidelines for the Protection of Aquatic Life.
- Coastech Research Inc. for Canmet MSL Division, 2008. MEND Project 1.16.1b, June 2008 Electronic Revision. Acid Rock Drainage Prediction Manual.
- Environment Canada, 2009. Environmental Code of Practice for Metal Mines.
- Golder Associates, Dec 2011. Guidance Document on Water and Mass Balance Models for the Mining Industry.
- International Cyanide Management Institute, 2011. The International Cyanide Management Code.
- International Network for Acid Prevention, 2009. Global Acid Rock Drainage (GARD) Guide.
- Mining Association of Canada, 2011. A Guide to Audit and Assessment of Tailings Facility Management.
- Mining Association of Canada, 2011. A Guide to the Management of Tailings.
- Mining Association of Canada, March 2007. Crisis Management Planning Guide.
- Mining Association of Canada, 2003. Developing an Operations Maintenance and Surveillance Manual for Tailings and Water Management Facilities.
- Mining Association of Canada, 2003. Energy and Green House Gas Emissions Management Guidance Document.
- Ministry of Energy, Mines and Petroleum Resources (B.C.), 1991. Operation and Monitoring of Mine Dumps – Interim Guidelines.
- Ministry of Energy, Mines and Petroleum Resources (B.C.), 1991. Investigation and Design of Mine Dumps: Interim Guidelines.
- Ministry of Energy Mines and Petroleum Resources (B.C.), 1995. Mined Rock and Overburden Piles Consequence Assessment for Mine Waste Dump Failures.
- Ministry of Energy, Mines and Petroleum Resources (B.C.), 1998. Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia.

- Okane Consultants Inc. July 2012. MEND Report 1.61.5c, 2012. Cold Regions Cover System Design Technical Guidance Document.
- Price, William A., Canmet Mining and Mineral Sciences Laboratory, 2009. MEND Report 1.20.1, Dec. 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials.
- SRK Consulting. 2009. MEND Report 1.61.5a. Mine Waste Covers in Cold Regions.
- SRK Consulting. 2010. MEND Report 1.61.5b. Cold Regions Cover Research – Phase 2.
- Transportation Association of Canada, September 1999 updated December 2011. Geometric Design Guide of Canadian Roads.
- Yukon Government, 2010. Yukon Mineral Explorations Best Management Practices for Heritage Resources.
- Yukon Government and Yukon Environmental and Socio-economic Assessment Board, Feb. 2012. Dam Guide, Design Expectations and Required Information.
- Yukon Workers' Compensation Health and Safety Board, Occupational Health and Safety Division, Dec 2011. Mine Emergency Response Plan: Guidelines for the Mining Industry.

Environmental Protection Plans

4.0 Site Characterization Plan

A Site Characterization Plan summarizes the environmental conditions for areas that are, or will be, affected by all aspects of a mining operation. This description should include footprint areas as well as environmental components that will be affected (e.g., watersheds, airsheds or wildlife ranges). Pre-disturbance and existing conditions must be addressed and should include descriptions of relevant reference areas. Descriptions must be accompanied by supporting data and analyses demonstrating a suitable understanding of site-specific environmental conditions. Details should be included as appendices.

Much of the information contained in this plan will have been compiled for an environmental assessment. New data collected or information gained throughout the assessment period must be included in this Plan.

The Plan should be updated as new information is gained through environmental monitoring activities on site. Any changes to this plan as a result of monitoring programs must be included in annual reports for both the Quartz Mining License and applicable Water Licenses for the project.

Suggested appendices: Water Balance Model, Temerature Data, Water Quality Data, Ground Water Model, Geotechnical Studies and Results and Geochemical Studies and Results.

4.1 Introduction

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

4.2 Geology

Provide a description of the regional geology, the geology of the ore body and any geotechnical issues associated with the rock type where infrastructure and major features will be located.

4.3 Climate and Hydrology

Describe climate conditions at the site, in sufficient detail to support water balance models and design. The parameters described must include, but not be limited to: temperature, rainfall, snowfall, snow accumulation, evaporation and any additional parameters needed to support water balance models.

Provide estimates of average and extreme precipitation including: annual extremes for design of storage requirements, peak storage requirements, peak flow capacity and daily extremes for design of conveyance facilities. Extremes for other durations may also be relevant, for example, extreme snowmelt events (duration approximately 6-7 months).

Include a description of the climate change scenarios that will be considered in the design of mine facilities and features.

4.4 Surface Water

Describe the hydrology of the site on a monthly time scale including: annual variability, high, low and mean flows. This should include analyses for various return-period and deterministic (e.g., probable maximum flood) flow events for watercourses, catchment areas and for any tailings impoundments. Site data should be provided, but analysis of extreme events will often need to incorporate regional analysis to utilize long-term data records. Correlations between site data and regional data should be discussed along with rationale for the approaches and data used.

A description of the water quality in water courses at the site, including the seasonal variability, identifying contaminants of concern as well as any parameters that may be appropriate indicators must also be included in this section. Water quality must be characterized for all parameters, providing summaries of results and analyses for at least monthly resolution. Include a description of any trends noted in water quality conditions. Characterize water quality for reference conditions, being careful to include reference locations that will not be affected by current or proposed activities.

In an appendix include all water quality results to support the summaries.

4.5 Ground Water

Describe the groundwater conditions at the site including: elevations, flow directions, permeabilities, water quality and interactions with surface water. Include appropriate models of groundwater conditions to support projections of how the mine site will interact with groundwater, and characterize potential flow paths and travel times for contaminants.

Provide modelling reports as appendices.

4.6 Vegetation and Wildlife

Provide a summary of vegetation and wildlife for the area that will be affected by the mining operations. Include a characterization of contaminant levels for areas that may be affected by contaminant migration from the site, via either air or water. Provide characterization of conditions in appropriate reference areas.

4.7 Soil and Bedrock

Describe the information about surface and subsurface conditions, including geology of the area including geomorphic features and bedrock composition.

Describe overburden materials, including material types, properties and layering. Describe the thermal conditions including depth, extent, moisture content and temperature (temperature profile if massive ice) of any permafrost.

Provide depths to bedrock and characteristics of bedrock, including strengths and permeabilities. Include site data from geotechnical testing and site investigations programs, including borehole and test pit logs and testing results (e.g., specific gravity, gradation, consolidation, bulk density, moisture content).

4.8 Seismicity

Describe seismic hazard conditions for the project site, including supporting analyses. Provide analyses for various return-period and deterministic (e.g., maximum credible earthquake) seismic events

4.9 Geochemistry and Geotechnical Information

4.9.1 Ore

Provide a detailed description of the geochemistry of the ore materials. Include results from mineralogy, acid-base accounting, shake flask tests, kinetic testing and column leach tests. Also describe and provide results for: leaching, rinsing, detoxification and neutralization test work, including details of expected water chemistry for each stage. Identify contaminants of concern for the project and provide rationales for the inclusions and exclusions. Provide projections of water quality associated with the ore materials during mine operations, heap rinsing, heap detoxification and post-closure.

Provide appropriate contaminant loading models to demonstrate how the ore materials will interact with the surrounding aquatic environment, in combination with effects from other mine components.

Describe the geotechnical characteristics of the ore including permeabilities under load, during heap leaching, rinsing and detoxification, geotechnical properties, etc.

Provide detailed test results as appendices.

4.9.2 Waste Rock

Provide a detailed description of the geochemistry of the rock and overburden materials. Include results from: mineralogy, acid-base accounting, shake flask tests, humidity cells and other test programs.

Include projections of water quality associated with the rock and overburden materials. Describe the expected pore water and seepage water quality and how it is expected to fluctuate throughout the life of the project.

Describe the geotechnical characteristics of waste rock and overburden materials including results from geotechnical testing.

Provide detailed test results as appendices.

4.9.3 Tailings

Provide a detailed description of the geochemistry of the tailings. Include results from: mineralogy, acid-base accounting, shake flask tests, kinetic testing, aging tests, column leach tests and other test programs. Identify contaminants of concern for the project and provide rationales for the inclusions and exclusions. Provide projections of water quality associated with the tailings materials. Describe the supernatant water, porewater, runoff, seepage and groundwater chemistries and how these will fluctuate through the life of the project.

Include contaminant loading models to demonstrate how the tailings will interact with the surrounding aquatic environment, in combination with effects from other mine components.

Describe the geotechnical characteristics of the tailing materials, including: specific gravity, gradation, settling density and consolidation.

Provide detailed test results as appendices.

5.0 Waste Management Plan

Over their life cycle, quartz mining undertakings are likely to produce both a combination of domestic and industrial wastes that will require management and disposal. The management of the miscellaneous domestic and industrial wastes that may be associated with a proposed quartz mining undertaking should be addressed in a Waste Management Plan. Domestic and industrial wastes are normally expected to include but not be limited to the following:

- Sewage;
- Construction and demolition waste;
- Waste oils, fuels and hydrocarbon residuals;
- Food waste;
- Paper and plastic products and packaging waste;
- Chemical waste including solvents, regents, batteries, anti-freeze, etc.;
- Gaseous and/or particulate air emissions; and
- Biomedical waste.

A Waste Management Plan will describe the methods used to manage solid, liquid, gaseous and special wastes of a domestic and industrial nature and gives details of the storage, handling and disposal of those wastes. The plan should identify waste reduction, reuse and recycling initiatives that are being implemented to reduce the overall production of waste materials at the mine site.

As the production, handling, storage and disposal of domestic and industrial waste can lead to the inadvertent creation of contaminated materials (affecting soil, water, air, or biota) the Waste Management Plan must identify how potentially contaminated materials at the mine site will be assessed and if necessary treated. Moreover the strategies for preventing the creation of contaminated materials should be identified.

In Yukon's regulatory context, the management of this category of waste (both domestic and industrial) excluding sewage is governed by the *Environment Act* and its regulations, which address the handling, storage, transportation, disposal and treatment of solid and special wastes. The *Environment Act* also has regulations relating to emissions that may result from burning or incinerating waste materials and to the identification and management of contaminated materials. The management of sewage is governed by the *Public Health and Safety Act* and its regulations, particularly the sewage disposal systems regulation.

Further information on the *Environment Act* and the regulations pertaining to solid waste, special wastes, contaminated sites and air emissions can be found at:

- http://www.env.gov.yk.ca/monitoringenvironment/solid_waste_regs.php
- http://www.env.gov.yk.ca/monitoringenvironment/special_waste_regs.php
- http://www.env.gov.yk.ca/monitoringenvironment/contaminated_sites_regs.php
- http://www.gov.yk.ca/legislation/regs/oic1998_207.pdf

Further information on the *Public Health and Safety Act* and its regulations pertaining to management of sewage can be found at:

- http://www.gov.yk.ca/legislation/acts/puhesa.pdf
- http://www.gov.yk.ca/legislation/regs/oic1999_082.pdf

Suggested Appendices: Issued Environment Act Permits, Issued Public Health and Safety Act Permits, Inspection Logs and Operational Checklists

5.1 Introduction

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

5.2 Waste Infrastructure

Provide the location and description of all infrastructure and equipment that is used in the handling, storage and disposal of wastes produced by the mine operations. This section should include a scaled figure showing the locations of all waste infrastructure components, including conventional and electric fences and the distances to other site elements (e.g., camps, fences, site boundaries).

5.2.1 Waste and Recyclables Storage:

Provide a description of how and where waste and recyclables generated at the site will be stored prior to final transfer, disposal or treatment.

5.2.1.1 Storage Areas:

Include a description and location of all storage areas, whether these are inside or outside buildings, and if outside, whether they are on the ground or on engineered liners/pads and whether they are completely or partially enclosed.

5.2.1.2 Storage Containers and Tanks:

Provide the type, number and location of all storage containers and tanks. Include details about what will be stored in each container or tank, how different streams will be segregated, whether the containers are animal-proof, whether secondary containment is provided for tanks and how big they are and how long items will be stored prior to final transfer or disposal.

5.2.2 Waste Disposal:

Provide a description of the waste disposal methods used at the site, including details about the construction of any natural works and equipment specifications.

5.2.2.1Landfill:

Provide a description of the landfill area to be used to bury solid wastes, including soil characteristics, hydrogeological characteristics (depth to groundwater, etc.), design permeability of a prepared natural liner or of a proposed engineered liner and how that will be confirmed, slope of the walls, access restrictions and cover material stockpile location(s).

5.2.2.2 Garbage Incinerator:

Describe any incinerators used at the mine site, including the manufacturer's specifications and other applicable information.

5.2.2.3 Open Burn Equipment:

If opening burning will be conducted onsite, include a description of any open burning equipment, including burn barrels.

5.2.2.4 Waste Oil Burner:

Describe any waste oil burners used at the mine site, including the manufacturer's specifications and other applicable information

5.2.3 Waste Treatment:

Describe the waste treatment methods used at the site, including details about the construction of any treatment areas and equipment specifications.

5.2.3.1 Land Treatment Facility:

Provide a description of the engineered land treatment facility used to store and treat soil, sediment, water, ice and/or snow that are contaminated with petroleum hydrocarbons. Include information on the location and dimensions of the facility; the depth, extent and permeability of any natural liner; the size and permeability of any engineered liner; the location, compaction and permeability of the berms; and the internal cell divisions.

5.2.3.2 Oil/Water Separator:

Include a description of the equipment used to separate oil from water, including manufacturer's specifications, dimensions, location and connections to other processes or locations.

5.2.3.3 Sewage Disposal Systems:

Provide a description of the infrastructure proposed or utilized for the management and disposal of sewage generated by the mining operations

5.3 Waste Management

Describe the types and amounts of solid and liquid waste generated at the site and how each waste stream is handled, stored, transported and disposed in ways that protect human health and the environment.

5.3.1 Waste Minimization:

Describe the activities undertaken to ensure that as little waste as possible is generated at the site, such as bulk purchases, minimizing packaging, etc.

5.3.2 Waste Generation:

Identify the types and amounts of waste expected to be generated at the mine site. Include domestic wastes, construction and demolition wastes, tires and other relevant waste streams generated at the mine site.

5.3.3 Recyclable and/or Reusable Materials:

Identify the materials that will be segregated for recycling or later reuse.

5.3.4 Off-site Transfer:

Identify the materials that will be transferred off site, how often, by what means, to where and whether they will be recycled or disposed.

5.3.5 Burial:

Provide a list/description of the waste streams that will be buried, and a description of the procedures that will be followed.

5.3.6 Open Burning:

Describe the waste streams that will be open-burned at the mine site, the mass, volume and composition of each batch, the number of batches per day or week and the procedures that will be followed to ensure a complete burn and minimal air emissions. This may include a discussion of the use of accelerants, procedures to control air intake

and/or temperature, monitoring of the burn and of ambient air quality, etc. Also describe what will be done with the residues, and with what frequency.

5.3.7 Incineration:

Describe the waste streams that will be incinerated at the mine site, the mass, volume and composition of each batch, the number of batches per day or week and the procedures that will be followed to ensure a complete burn and minimal air emissions. This may include a discussion of the use of accelerants, procedures to control air intake and/or temperature, monitoring of the burn and of ambient air quality, etc. Also describe what will be done with the residues, and with what frequency.

5.3.8 Inspections and Record Keeping:

Describe inspections that will be undertaken by workers to ensure that permit conditions and operational commitments are met, the frequency of these inspections and the records that will be kept to document inspections, noted deficiencies and activities conducted to remedy those deficiencies.

5.4 Special Waste Management

Provide a description of the types and amounts of special wastes generated at the site and how each special waste stream is handled, stored, transported and disposed in ways that protect human health and the environment.

5.4.1 Waste Types, Sources and Amounts:

Provide a list of the types, amounts and sources of special waste expected to be generated at the mine site. This list may include, but not be limited to, waste oil and filters, waste diesel, waste gasoline, waste antifreeze, waste solvents, waste lead-acid, batteries, waste mill reagents and containers, waste pesticides, waste aerosol containers and biomedical waste.

5.4.2 Waste Handling and Storage:

Describe the handling, storage and segregation of special wastes. Include details of inventories that are kept and the frequency with which those inventories are updated; locations and design of waste collection and storage areas and any secondary containment or monitoring systems that will be in place; whether and how each type of special waste will be kept separate from the others; how wastes will be labelled; how wastes will be protected from inclement weather; and any other precautions that will be in place to ensure wastes are not released to the environment. An outline of any personal protective equipment or special precautions that are required for the handling of various types of special wastes must also be included.

5.4.3 Off-Site Transfer:

Identify the types of special waste that will be transported off-site for disposal, how the wastes will be transferred off-site and how often.

5.4.4 On-Site Waste Disposal:

Provide a description of on-site disposal methods to be used for each type of special waste. If waste oil is to be burned in a waste oil burner, identify the specific types of oil that will be burned in the unit and provide information from the manufacturer that such feedstock is approved. For all on-site disposal methods, describe any anticipated residuals and what will be done with them.

5.4.5 Spill Prevention and Response:

Describe the procedures to be used to prevent spills of hazardous materials or special wastes, and the procedures to be followed in the event of a spill. If a separate Spill Response Plan has been prepared to address these elements, refer to it here.

5.4.6 Inspections and Record Keeping:

Describe inspections that will be undertaken by workers to ensure that permit conditions and operational commitments are met, the frequency of these inspections and the records that will be kept to document inspections, noted deficiencies and activities conducted to remedy those deficiencies.

5.5 Contaminated Materials

Describe how contaminated or potentially contaminated soil, sediment, water, snow and/or ice will be assessed and treated, including procedures to ensure that all contaminated material has been appropriately dealt with.

5.5.1 Assessment:

Describe the steps to be taken to assess the type, level and extent of contamination in any environmental media affected by the spill. All assessment work must be done in accordance with the requirements of the *Contaminated Sites Regulation* and the various protocols in effect under it.

5.5.2 Treatment:

Describe how common types of contaminated material will be dealt with. This may include transfer off-site to a permitted treatment facility, removal to a permitted on-site treatment facility or other options appropriate to the type and level of contaminants. If contaminated material is to be treated in an on-site land treatment facility, provide

details about how material from different sources will be segregated within the facility, what moisture and/or soil amendments will be applied to soil in the facility, how often the soil will be turned or tilled, etc.

5.5.3 Confirmatory Sampling:

Describe the steps to be taken to ensure that all contaminated material has been removed from the spill site. If contaminated material is to be treated in an on-site land treatment facility, this section should also include how the material will be confirmed to have been successfully treated prior to removing it from the facility. All remediation work and confirmatory sampling must be done in accordance with the requirements of the *Contaminated Sites Regulation* and the various protocols in effect under it.

6.0 Hazardous Materials Management Plan

Quartz mining undertakings invariably require the direct or indirect use of a number of products that are classified as hazardous materials under both Federal and Yukon legislation. Hazardous materials commonly expected at quartz mining undertakings include fuels, lubricants, solvents, antifreeze, explosives and mineral processing and water treatment reagents.

In respect of such materials, it is necessary for the proponent to identify all hazardous materials that will be utilized and to demonstrate that appropriate planning for the transportation, storage, use, handling and disposal of hazardous materials has been developed.

A Hazardous Materials Management Plan describes the transportation, storage, use, handling and disposal of hazardous materials utilized at the mine site to ensure protection of the environment and human health. The plan also identifies contingency plans to respond to and clean up spills of hazardous materials.

In most cases a single overarching plan is expected to be sufficient for all of the normally expected hazardous materials utilized in a quartz mining undertaking. However the use of high hazard materials such as cyanide may lead to an additional standalone plan being appropriate for such materials

In Yukon's regulatory context, the management of hazardous materials is a governed by the *Dangerous Goods Transportation Act* and regulations under the *Environment Act*.

Suggested Appendices: Material Data Safety Sheets, Spill Response Plan

6.1 Introduction

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

6.2 Hazardous Materials Identification

Identify each hazardous material used at the mine site, by chemical and common names as applicable. Include all Material Safety Data Sheets (MSDS) in Appendix A and ensure these are updated in accordance with all relevant regulations. Identify all

locations where copies of the MSDS and this Hazardous Materials Management Plan are available on site.

6.3 Employee Training

Describe all training that employees must complete prior to handling hazardous materials, including proper handling techniques, use of personal protective equipment and familiarity with the site layout and emergency stations.

6.3.1 Workplace Hazardous Materials Information System:

Identify the WHMIS training that is available for employees who deal with hazardous materials and the frequency with which the training is updated.

6.3.2 Transport of Dangerous Goods:

Describe the training available to employees who transport dangerous goods and/or special wastes, and the frequency in which this training is kept up to date.

6.3.3 Personal Protective Equipment:

Provide a description of all personal protective equipment that employees are required to wear when handling hazardous materials.

6.4 Hazardous Materials Segregation and Storage

Provide a description of how hazardous materials will be segregated on site, where the various types of hazardous materials will be stored, any secondary containment structures that will be in place, how materials will be handled and the disposal methods for each substance.

6.5 Hazardous Materials Disposal

Provide a description of how the various types of hazardous materials used at the mine site are to be disposed. For each disposal method, identify whether this is done on-site or off-site and the frequency of recycling/disposal. If on-site, identify what equipment is used to recycle or dispose of the hazardous waste material and what testing is performed to verify that proper recycling or disposal has occurred. If off-site, identify how the waste hazardous material is transferred off site, by whom and to where.

6.6 Spill Prevention and Response

Describe the procedures to be used to prevent spills of hazardous materials or special wastes, and the procedures to be followed in the event of a spill. If a separate Spill Response Plan or Emergency Response Plan has been prepared to address these elements, refer to it here.

7.0 Environmental Monitoring, Surveillance and Reporting Plan

An Environmental, Monitoring, Surveillance and Reporting Plan (the Plan) is used to track the performance and effects of a project on the environment relative to its predicted performance and effects. The Plan should identify what variances from predictions are occurring and whether such variances require action to ensure that the environment is protected. The Plan will normally comprise a series of programs intended to monitor key aspects of the project performance and of the environment potentially affected by the project. The Plan and its constituent programs should encompass all phases of the mine life from development through closure.

Typically the Plan will include programs for monitoring: water, geochemistry, climate, physical performance of mine workings and environmental management infrastructure and effects on the aquatic and terrestrial environment.

For each unique mining project, the environmental assessment process and subsequent permitting processes required under the *Quartz Mining Act*, the *Yukon Waters Act*, the *Fisheries Act* and its metal mining effluent regulations and the *Yukon Environment Act* will identify project specific monitoring programs that will be required as part of the Plan. In addition, mine proponents may include voluntary monitoring programs not linked to specific regulatory instruments as part of the Plan.

For each individual monitoring program that is required or proposed in the Plan, the following generic elements should normally be included:

- A description of the program's design and objectives;
- Figures and descriptions of specific monitoring areas, locations or stations;
- Schedules for monitoring activities;
- Documented procedures for monitoring activities;
- Documented schedules and procedures, including the role and responsibilities of project staff, for internal and external reporting of monitoring activities and results; and
- For programs involving measuring, sampling or testing environmental media (soil, water, air, biota), documented quality control and quality assurance (QC/QA) processes.

The individual monitoring programs forming the Plan may be relatively simple or very complex depending upon the nature of the actual project and the regulatory conditions that have been assigned. For complex programs, summary level information may be presented in the Plan document and the full details provided in an appended or

referenced standalone program document or management plan. If it is deemed efficient, standalone manuals such as a Field Procedures Manual or a Quality Assurance/ Quality Control (QA/QC) Manual that encompasses or refers to one or more programs may also be developed and appended to the Plan.

For relatively simple Plans, some of the repetitive generic elements of the individual programs may be presented in a common section of the Plan document as opposed to within each program section in the document. For example, for simpler projects the reporting procedures may often be presented for all or most of the Plan's programs in a single section of the Plan document.

Regardless of the approach utilized to present the information, it is recommended that the Plan documents be organized and written to convey the Plan information in a manner that is understandable and useful to all parties with an interest in the Project. Moreover, the Plan documents should be suitable for the purposes of the project staff that will ultimately be responsible to execute the Plan. Finally, the Plan layout should be suitable to allow it to be used as a template for both an internal and external audit of the monitoring programs.

Suggested Appendices: Maps and Figures, Field Procedures Manual, QA/QC Manual

7.1 Introduction

Summarize the regulatory monitoring required or proposed for the project and of the programs that will be completed to satisfy the regulatory requirements. Also provide an outline of key staff with responsibilities for the management of the Plan.

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

7.2 Water Monitoring Program

A water monitoring plan for a quartz mining project will normally include surface water and groundwater components. For both components monitoring of water quality and water quantity will be required. The developed program should clearly identify its linkage with regulatory instruments, in particular with existing, anticipated or requested water use licences that relate to the mining undertaking.

Surface water monitoring is normally expected to include stations upstream and downstream of the project and stations within the project sufficient to map and monitor the progressive use of water from all sources to all subsequent (if any) releases to the environment. Specific monitoring of water flowing into pits or pit lakes should be included.

Flow monitoring of surface water may take various forms from simple seasonal spot checks (stream gauging, bucket tests, etc.) to near continuous measurement with flow meters or pressure transducers. It is important to identify the rationale for selected flow measurement methods and frequency.

Groundwater monitoring should include monitoring wells and piezometers up gradient and down gradient of proposed activities, and should be sufficient to monitor all known aquifers that may be affected by the project. Ground water monitoring should also include monitoring of water entering into underground workings (if any). Ground water flow will normally be measured indirectly based on well water levels and piezometric pressures.

For both groundwater and surface water, the parameters that will be monitored should be defined both for field monitoring activities and laboratory activities. QA/QC procedures are considered to be critical for water monitoring activities and should encompass calibration and validation of field measurement equipment as well as sample QA/QC measures.

7.3 Geochemical Monitoring Program

A number of typical management plans for quartz mining undertakings will identify a requirement for monitoring the geochemistry of exposed geological materials, materials sources for construction purposes and of mine waste materials such as overburden soils, waste rock, low grade ore, tailings, heap leach residuals, backfill paste, pit walls, mine walls and treatment sludge. This section of the Plan should identify all geochemical monitoring activities including but not limited to:

- Field and laboratory geochemical characterizations tests of exposed or mined materials (assays, ICP scans, etc.);
- Predictive tests including humidity cells, leach columns, field test pads or bins, pit or mine wall washing stations and kinetic tests that will be conducted to monitor the acid rock or metal leaching potential of exposed and residual materials;
- Field validation tests of placed materials such as tailings and paste backfill to monitor their actual physical and geochemical properties over time including (where appropriate) in situ density, hydraulic conductivity, leachate quality and the development of secondary minerals.

As with water monitoring, QA/QC provisions are considered to be critical to ensure that the monitoring plan is adequate.

7.4 Meteorological Monitoring Program

Include a description of the location and type of weather station(s) installed, the parameters that are measured, the frequency of measurement, and how often the data is downloaded from the station. This section must also include any snow surveys that are conducted on site and the frequency and locations of these surveys.

The plan should identify how the collected data will be used to update the predictions for extreme events or for performance predictions for the project that have been based on the baseline climatic data that was previously available.

7.5 Mine Infrastructure and Working Monitoring Program

This section should outline activities that will be completed to monitor the physical performance of key mine infrastructure and of mine workings. This would include but not be limited to monitoring of tailings impoundments or dry stacks, water supply dams, water conveyance networks, sediment and treatment ponds, heap leach pads and stacks, overburden and waste rock waste dumps, open pit walls, access roads and underground workings. Key issues that should be addressed are;

- The physical stability of slopes and dams;
- The integrity of liners and covers;
- The occurrence of deformation and settlement of structures and mine openings;
- The stability of conveyance channels and spillways (i.e., the development of scour or erosion of channel materials); and
- The development of surface erosion on structures.

Normally it is expected that physical performance monitoring will include frequent, routine inspections by field staff, collection and interpretation of instrumentation data and at least annual inspections and reviews of collected data by professional engineers. Special inspections following severe events such as large floods or seismic events are also expected to be identified in the physical monitoring program. Structures with a significant environmental or life safety risk will often be expected to have a specific operations, maintenance and surveillance manual developed that will include identifying physical monitoring requirements.

7.6 Aquatic Environmental Monitoring

Both the Water Use Licence and the metal Mining Effluent Regulations of the *Fisheries Act* will require some specific monitoring of the aquatic environment that could be impacted by the project. This section should present proposed or required aquatic

monitoring activities that at least satisfy the regulatory requirements. In general such activities will include sampling, testing and analysis of sediment and biota from the aquatic environment.

7.7 Terrestrial Environmental Monitoring

The Quartz Mine Licence and permits issued under the *Environment Act* will normally identify a requirement to monitor the potential effects of the project on the terrestrial environment. Typical requirements include activities and management plans related to:

- Fugitive dust;
- Metals uptake in vegetation;
- Permafrost degradation; and
- Wildlife.

This section should present or summarize all proposed or required terrestrial effects monitoring.

7.8 Progressive Reclamation Effectiveness Monitoring Program

Progressive reclamation is an important element of managing the effects of mines in Yukon. Monitoring the effectiveness of progressive reclamation is required to ensure that the reclamation measures are successful and that continuous improvement occurs. Moreover, the effectiveness of early progressive reclamation efforts can be used to inform larger scale reclamation activities that may be required during closure of the project. This section should outline and describe the monitoring program that is in place to assess the effectiveness of reclamation efforts.

7.9 References

As noted many aspects of a mining project will generally require the development of a specific management plan. For example, a tailings management plan or a fugitive dust management plan. Such plans generally provide the rationale and requirements for specific monitoring activities, and therefore they should be referenced in this Plan. The reference should identify the version of management plans that have been used to develop the contents of the Plan.

Another document that should be referenced is a baseline conditions summary report (most current version), as that document will often be utilized to identify potential effects on the environment.

In addition to referencing management plans, other documents utilized in the development of this plan should also be referenced.

8.0 Wildlife Protection Plan

A quartz mining project, through development, operation and closure, will invariably cause interaction with and possible disturbance to wildlife and wildlife habitat. In order to minimize these potential effects a Wildlife Protection Plan must be submitted to support a Quartz Mining License application.

A Wildlife Protection Plan describes how wildlife disturbance will be minimized at the site through the establishment of wildlife protection policies, employee education, management of traffic on roads and trails, elimination of wildlife barriers, and avoiding disturbance and harassment of wildlife in the area.

In Yukon's regulatory context the protection of wildlife and wildlife habitat is managed under the *Environment Act* and Regulations. Yukon does not currently have its own species-at-risk legislation. Therefore, when endangered species or species at risk are present, the applicable federal legislation will apply and must be considered when developing a Wildlife Protection Plan.

Further information that could aid the development of a Wildlife Protection Plan can be found at:

- http://www.env.gov.yk.ca/publications-maps/brochures.php#wildlife
- http://www.env.gov.yk.ca/publications-maps/brochures.php#bears
- http://www.env.gov.yk.ca/publications-maps/documents/proponents_guide_bear_risk.pdf

Suggested Apendices: Guidelines for Minimizing Disturbance to Wildlife and the Habitats Monitoring Activities, Wildlife Records Program, Procedures for Reporting Wildlife Incidents and Observations, Winter Wildlife Monitoring Protocol, Metal Levels in Vegetation Protocol, Metal Levels in Small Mammals Protocol

8.1 Introduction

Provide a brief overview of the project description, describe how wildlife use the area, indicate if there are any areas of concern within the project footprint, and describe the key areas where the project has potential to affect wildlife in the area. If First Nations were consulted during the development of this plan a summary of their key issues and concerns should be outlined along with how these issues are addressed in the Wildlife Protection Plan.

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conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

8.2 Wildlife Resources

Provide a summary of the wildlife that is supported by the habitats in the vicinity of the project, identify any wildlife corridors or migration routes that are used, and describe any wildlife features (e.g., breeding grounds, mineral licks, dens, nests, etc.) that are within the project area.

Provide a description of any Valued Ecological and Cultural Components ("VECC") that were identified during the environmental assessment and the rationale for why each species was identified as a VECC.

Include a summary of the seasonal periods, occurrence, and available habitat for all wildlife VECCs in the vicinity of the project. An overview of the habitat availability and classification for each VECC must also be provided in this section.

8.3 Wildlife Protection Procedures

Provide an overview of the management and mitigation strategies and actions that will be implemented to minimize the impacts to wildlife and their habitat. A summary of the training available to employees and visitors on wildlife protection procedures is also required in this section.

Describe how the site will be designed and constructed to reduce wildlife interaction. Include the procedures that will be carried out to minimize conflicts between wildlife and employees or visitors. Provide details of what animal attractants are on site, how the attractants are stored, and the procedures that are in place to reduce wildlife-human conflicts due to attractants. Include an outline of the procedures that will be put in place to minimize impacts to traditional land users and guide outfitters.

Describe how impacts to wildlife from the mine operations will be minimized. Activities that should be described include, but are not limited to, operating procedures for transportation routes, on-road and off-road vehicles, heavy equipment, and aircraft and controls or deterrents used restrict wildlife access to tailings storage facilities or other high risk mine facilities. Identify the procedures that are in place to manage potential impacts to wildlife from direct and indirect habitat loss.

8.4 Monitoring

Describe the recording program that is in place to document all wildlife observations and incidents and how this data will be used to identify existing or potential issues and areas of concern between wildlife and project components. Include a description of how rare species will be documented and reported. This program should include waterfowl and shorebird occurrence and distribution on all tailings ponds or other large storage ponds.

Include a description of the program and methodology to monitor the occurrence, distribution and movement of wildlife on and near the mine site. If monitoring programs differ between seasons indicate the seasonal-specific monitoring programs that are in place. Include a description of how the data will be used to assess the effects to wildlife occurring from mine activities.

Describe the program and methodology to monitor the baseline metal concentration in wildlife forage plants and small mammals and how the data will be used to assess the effects that the mining operation is having on these levels.

8.5 Adaptive Management

Describe the adaptive management actions that will be employed should negative effects on wildlife be observed.

9.0 Spill Contingency Plan

Chemicals, fuels and reagents are continually handled during a quartz mining operation. Proper handling, storage, and spill response are essential for the operation of an environmentally stable project. Prior to undertaking activities on a site an operator must submit a Spill Contingency Plan to describe the procedures that will be followed in the event of a spill.

A Spill Contingency Plan is a tool to communicate to staff, contractors, and workers the actions to be taken when responding to spills during mine construction, operation and closure. The plan should also identify the lines of authority and responsibility in the event of a spill.

In Yukon's regulatory context, the management of spill response is governed by the *Occupational Health and Safety Act* and regulations under the *Environment Act*. Moreover the *Quartz Mining Act* regulations and *Waters Act* regulations require that a plan for spill response be provided as part of an application for a Quartz Mining License or a Water Use License.

Further information on the *Spills Regulations* and Spill Plan Requirements can be found at:

- http://www.env.gov.yk.ca/environment-you/spills.php
- http://www.env.gov.yk.ca/environment-you/documents/spills2_spill_response_plans.pdf

Suggested Appendices: Material Data Safety Sheets, Spill Report Plan, Emergency Telephone Contacts

9.1 Introduction

Provide a brief description of what fuels, chemicals and other materials (e.g., oils, solvents, and antifreeze) are handled at site and where they are typically used and/or stored. Identify the locations of hazardous waste storage areas, areas of use, and spill kits.

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9.2 Spill Categories

Provide a summary of all the reporting thresholds for chemicals and fuels used on site. Include a description of how non-reportable spills will be handled and how these incidents are recorded.

9.3 Spill Action Plan

Identify the supplies and equipment that are available for spill responses, and the location where equipment and supplies are found. Provide a list of all supplies that are contained in spill kits, any additional supplies that are in the kits at stationary caches, and the frequency which the supplies are inventories and replenished. Identify the equipment that is available for responding to larger spills.

Identify what should be done by the first worker attending a spill site. Typically this will include such actions as assessing whether it is safe to take any action; stopping the spill and/or turning off equipment; establishing basic containment to keep the spilled material from spreading; getting help and/or reporting the spill to a supervisor so they can send help and initiate reporting, etc.

Describe the containment protocols for each spillable material in soil, water, snow and ice. List spill response actions for each scenario, taking special note of any unusual situations or chemical reactions that may occur. Guidelines for selecting containment techniques on water and land must also be provided.

Include the clean-up protocols for each spillable material in soil, water, snow and ice. Provide a description of how collected spilled material, used spill response equipment, and contaminated soil and snow/ice will be handled, stored and treated. (Note that permits are required to move contaminated material off-site or to construct storage/treatment areas on-site.) Identify how it will be demonstrated that all contaminated soil/water/etc. has been captured. Include a description of the spill response procedure for accidents/incidents that have been ignited.

Provide a chart that outlines the responsibilities of various workers in the event of a spill. A summary of the roles and responsibilities of the employees involved in spill clean-up and reporting must also be provided in this section. Include a list of all off-site resources available in the event of a major spill.

9.4 Internal and External Reporting

Describe the sequence of reporting that will be followed to ensure an efficient and effective response occurs, and outline the agencies with which spill reports must be filed. Include a list of reporting and emergency contacts and their contact information.

9.5 Training Requirements

Describe the spill response training that all employees must take and the frequency that training is to be updated/reinforced. Identify the different training opportunities that are mandatory and/or available for the different respondents to spills on site.

9.6 Spill Prevention

Describe the best management practices that relate to the storage of fuel, chemicals and hazardous substances.

9.7 Fuel Transfer

Describe the training that will be provided for employees who handle, transport, or store fuel and lubricants and the procedures that will be followed. Include the procedures in place for fuel spill prevention and protection. Provide the procedures in place to prevent the accidental release of fuel to the environment.

9.8 Routine Maintenance and Monitoring

Provide an outline of responsibilities for site services staff and environmental department staff with regard to inspections that will be carried out to identify if there are any leaks, losses, blockages or other equipment issues. Also identify any intrinsic monitoring/alarm systems.

Outline the procedures to identify any leaks, spills, stains, etc. in or around fuel, chemical and hazardous material storage and transfer areas. Also identify any intrinsic monitoring/alarm systems.

Provide a brief outline of the procedures that are in place to ensure proper waste management and segregation, including any intrinsic monitoring/alarm systems.

10.0 Sediment and Erosion Control Plan

The development and operation of a quartz mine involves significant earth moving activities which may result in erosion of surface features or sedimentation in watercourses. A Sediment and Erosion Control Plan describing control features must be submitted prior to commencement of any earth moving activities in order to minimize the potential effects of erosion and sedimentation.

A Sediment and Erosion Control Plan is used to demonstrate the operational procedures and best management practices which minimize potential effects to the environment and ensure the stability of infrastructure on site.

The management of the environmental risk of sedimentation and erosion is governed by the *Quartz Mining Act* and regulations and the *Environment Act*.

Further information on sediment and erosion can be found at:

- http://www.env.gov.yk.ca/publications-maps/documents/bestpractes_water.pdf (see Section 2.1)

10.1 Introduction

Provide an overview of the project description, the areas where erosion may be a concern, and the objectives of this plan.

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10.2 Monitoring Strategies

Describe the monitoring protocols for identifying and responding to all instances of sedimentation or erosion.

10.3 Erosion and Sediment Sources

Identify all areas where erosion or sedimentation may be a concern, if the areas can be avoided, and the level of concern associated with each area.

10.4 Erosion and Sediment Control Measures

Provide a detailed description of the methods of sedimentation and erosion prevention and control that will be used, the specific situations that they will be used in, and the implementation procedures that will be followed. Measures may include but are not limited to, ditching and damming, use of filter fences, re-contouring of surface features, revegetation, and sheeting.

Development and Operations Plans

11.0 Mine Development and Operations Plan

A Mine Development and Operations Plan will describe the proposed mining methods for the project including the required infrastructure and support equipment. This plan will also describe the physical monitoring program that will be established to ensure the stability of all open pit and underground workings at the mine site.

This plan must be accompanied by issued-for-use construction drawings stamped by an engineer licensed to practice in Yukon. Final as-built drawings are required after a facility is constructed, or when a mining area is completed.

In Yukon's regulatory context, mining activities undertaken at a quartz mine are governed by the *Quartz Mining Act* and regulations and the *Occupational Health and Safety Act* and regulations.

Further guidance on the development of this plan can be found at:

- http://www.wcb.yk.ca/
- http://wcb.yk.ca/ActsPoliciesAndRegulations/OccupationalHealthAndSafety/Default.aspx
- http://www.wcb.yk.ca/Media/documents/OHSPart15minesandprojects.pdf

Suggested Appendices: Design Drawings, Stability Assessment, Material Data Safety Sheets, Spill Response Plan

11.1 Introduction

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

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11.2 Design Criteria

Provide the design criteria that guide the open pit and/or underground design including project constraints, regulatory and guidance-based criteria and other criteria. These are the criteria that will define the effectiveness of the proposed design. Criteria should be described for all components of the system, recognizing that criteria may vary depending on risks associated with specific components or processes. Rationale for selection of all criteria should be provided. Where criteria are developed in accordance

with regulatory requirements or guidance documents, rationales must clearly demonstrate how the proposed criteria meet these requirements or guidance. If different criteria will be applied during different project phases, these should be specified. If the criteria are based on detailed site-specific analyses (e.g., water balance and stability analyses), these should be referenced and provided. Some common types of criteria are identified below, with key reference documents noted.

Design documentation should demonstrate how the proposed design achieves the design criteria.

11.2.1 Ore Quantities:

Provide an overview of the geology of the deposit and the ore zones. Include an ore reserves estimate, the planned annual mining rate, and the mine life based on the reserves and annual mining rate. Provide an outline of ore tonnages and grades, daily mining rate, and planned monthly mining rates with diluted averages.

11.2.2 Geotechnical Assessment:

Provide a geotechnical assessment that describes the competency of the rock, and describe the methods that were used to determine the rock mass quality on site rock masses on site, and a summary of the typical rock mass qualities for all ore bodies and zones. Provide the point load strength index for the different rock types. Describe seismic design events, factors of safety, and slope angles.

11.3 Design and Construction

Designs and construction plans must account for site-specific conditions including adverse geotechnical conditions and extreme climatic events. Designs must demonstrate how the proposed facilities will meet the design criteria, and that they will be stable both during construction and in the long term. Designs must include the following information:

11.3.1 Site Preparation:

Describe site clearing, stripping and grubbing and foundation preparation. Include areas to be cleared and volumes of material removed. Identify storage locations for waste materials generated from construction activities. For foundation preparation, describe how unsuitable in-situ materials, such as ice-rich permafrost, soft, or weak materials will be identified and addressed.

11.3.2 Construction Quality Assurance/Quality Control:

Describe the construction Quality Assurance/Quality Control (QA/QC) program that will be implemented to ensure that construction activities will achieve expected performance. Also describe how the construction quality assurance/quality control program will ensure appropriate implementation of construction constraints related to climatic conditions like wet, dry and freezing conditions.

11.3.3 Stability Analyses:

Describe the results of stability and settlement analyses for proposed facilities. These must be supported by site-specific sampling and testing of materials proposed for construction of the facilities, providing realistic and defensible material strengths and properties. Evaluate factors of safety for static and seismic conditions. Stability and settlement analysis reports should be included as appendices.

11.3.4 Construction Schedule:

Describe the construction schedule, addressing proposed construction phases, and also seasonal scheduling. Identify schedule constraints related to climatic conditions.

11.3.5 Material Release Schedule:

Provide a material release schedule for all open pits and underground workings.

11.3.6 Ore Handling Procedures:

Provide a description of how ore will be handled on site, including location and design of stockpiles, segregation protocols, stockpile inventories, and projected life of stockpiles.

11.4 Associated Mine Services and Infrastructure

11.4.1 Ancillary Infrastructure:

Provide a description and diagram showing all infrastructure associated with the mine. Include a singleline diagram of the power facilities on site, stamped by a professional engineer. Provide a brief description of the communication capabilities on site, and if compressed air will be utilized.

11.4.2 Waste Rock, Ore, and Tailings Management:

Provide a brief description of the waste rock and high grade and low grade ore storage locations and the segregation protocols. Describe any dynamic stockpiles that will be on site, and the timing of these facilities. Include an overview of the tailings disposal method and location.

11.4.3 Industrial Complex:

Include a description of any additional areas that will serve as staging areas for equipment and any buildings that will be used to house or service these pieces of equipment.

11.4.4 Fuel Storage:

Provide the numbers of gasoline and diesel fuel tanks required, the capacity of each tank, and the storage location. Include a fuel storage site layout diagram. Include the number of propane tanks required, the capacity of each tank, the storage location(s), the quantities of propane required for major mine components, and how long the quantities will last during winter operations.

11.5 Underground Mining Design and Methods

Provide a complete description of the underground mining methods, including construction, development and operation must be described in the following sections:

11.5.1 Mine Design and Methods:

Provide a description of the mine design, where the ore zones are, how each zone will be accessed. All designs submitted for the plan must be stamped by an engineer licensed to practice in Yukon. This section will describe the details of mine construction and development.

11.5.1.1 Portal and Decline:

Provide the location of the portal and the design of the decline. Include details of laydown areas outside of the portal.

11.5.1.2 Mining Method:

Describe the mining methods that will be used. If multiple mining methods will be employed describe the specific characteristics that will determine the use of each mining method.

Describe how each mine area will be developed, the dewatering protocols, how the ore will be intersected, and how each area will be accessed from the previous. Include in this section the blasting procedures that will be followed.

Describe how the ore will be extracted from a mining area, the sequence of mining, and how each mine section will be tied into the next.

11.5.1.3 Backfill Procedures:

Provide detailed plans of the backfilling procedures, outline when each area will need to be backfilled, and describe the materials that will be used for backfill. Include a detailed description of the monitoring program that will be used to assess the stresses placed on any ground control system used. Include a list of all instrumentation equipment, where it will be installed, and the frequency of monitoring. Describe both the instrumental monitoring and visual observations that will take place. Provide a diagram showing all monitoring locations

11.5.1.4 Emergency Measures:

Provide details on all emergency measures including secondary exits, refuse stations, and communication equipment. All emergency response protocols must be provided under separated cover in an Emergency Response and Health and Safety Plan.

11.5.2 Ventilation:

Describe the type of ventilation system that will be used including a description of the power requirements of the system, the number of intake fans, where the fresh air intakes are located, any secondary fans that will be installed, and the design of the ventilation system. Describe how the mine air will be heated, the times of year in which the air is heated, and the temperature that the mine air will be heated to. Provide an engineered schematic design of the mine ventilation system.

11.5.3 Ground Support Methods

Provide a detailed description of the type of ground support that will be used in the underground mine. Include the rock mass classification system for each rock type that will be encountered in the mine openings, and how the support of each of these rock types will have to be adjusted. Include information such as bolt spacing, length, and capacity, pillar size and spacing, any temporary shaft or barrier pillars that will be necessary, if waste or hydraulic fill will be required, and any other support method that the mine will be using.

11.5.4 Ground Support Monitoring Instrumentation

Describe the monitoring program that will be used to assess the effectiveness of the ground support methods being used. Include a list of all instrumentation equipment, where it will be installed, and the frequency of monitoring. Describe both the instrumental monitoring and visual observations that will take place. Provide a diagram showing all monitoring locations.

11.6 Open Pit Mining Design and Methods

11.6.1 Mine Design

Provide the detailed designs for the open pit; include the final pit walls, the bench spacing, depth of final pit, and access roads. A detailed schematic of the starter pit, pit stages, and final pit designs must be included.

11.6.1.1 Wall Design and Overburden Stability

Describe how the wall design considers overburden stability, include the factor of safety and the probability of failure. Provide the bench sizes that will be utilized to ensure the pit walls will remain stable throughout pit development.

11.6.1.2 Ground Movement Monitoring

Provide a detailed description of the monitoring program that will be used to assess the pit wall stability. Include a list of all instrumentation equipment, where it will be installed, and the frequency of monitoring. Describe both the instrumental monitoring and visual observations that will take place.

11.6.1.3 Blasting and Wall Control

For each open pit provide the blasting procedures, the bench height ratio, and the wall stabilization practices that will be used. Include diagrams of the typical bench loading configurations.

11.6.2 Haul Roads

Include the design parameters for haul roads within the pit including road width, safety berms, and emergency routes. Describe the procedures for operating vehicles and equipment within the pit walls and outline the vehicle passing procedures and determination of right of way.

12.0 Mill Development and Operations Plan

The construction and operation of a mill facility is an integral part of most quartz mining undertakings. It is necessary for the proponents to describe both the construction of the facility, and the operating procedures to demonstrate the mill can be operated in an environmentally safe manner.

A Mill Development and Operations Plan will include the mill design, milling and production rates, a schedule for ramp-up and start dates, plans for and identification of stockpiles, details on reagent use and storage, and the requirements for load-out and trucking.

In Yukon's regulatory context, the construction and operation of a mill facility is governed by the *Quartz Mining Act* and regulations.

A Mill Development and Operations Plan should include the following information outlined below; however, additional components may be required as a result of an environmental assessment or as a result of applications for, or permits issued under the *Environment Act*, the *Quartz Mining Act*, the *Waters Act*, the *Public Health and Safety Act*, or any other federal or territorial acts

Suggested Appendices: Material Data Safety Sheets, General Arrangement Drawings, Issued for Use Design Drawings

12.1 Introduction

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

12.2 Site Preparation

Describe site clearing, stripping and grubbing and foundation preparation. Include areas to be cleared and volumes of material removed. Identify storage locations for waste materials generated from construction activities. For foundation preparation, describe how unsuitable in-situ materials, such as ice-rich permafrost, soft or weak materials will be identified and addressed.

12.3 Mill and Ancillary Infrastructure

12.3.1 Mill Facilities:

Describe all the equipment and infrastructure that is required to operate the mill. Provide a diagram that shows the detailed arrangement of the interior and exterior milling equipment

12.3.2 Ore Stockpiles:

Provide a detailed description of any mill-specific ancillary facilities (i.e., fine or coarse ore storage pads, temporary tailings storage area, and concentrate load-out area). If ore or waste rock facilities will be present at the mill site include a description of these facilities. If the facilities are temporary provide an estimate of how long these facilities will be required and when the facilities will be decommissioned.

12.3.3 Tailings Facilities:

Describe the type of tailings that will be produced during the process, identify where the tailings will be disposed of, and provide a brief overview of the tailings storage facility. A detailed Tailings Management Plan is required under separate cover.

12.3.4 Water Management System:

Provide a description of the water management system that will be used to operate the mill, transport and store the tailings, and convey the makeup water. Include a description of the disposal process for effluent from the mill site. This description must include schematic designs of any water treatment or retention systems.

12.4 Milling Methods

Provide the mill process description based on the annual mill feed rate. Include a schematic design for the full milling process and the individual circuits.

12.4.1 Crushing Facilities and Sequence:

Provide a description of the crushing process, including how ore is fed into the crusher(s), the capacity of the crusher(s), the components and equipment involved in each crushing circuit, the crush size achieved, and any dust suppression or collection systems that will be employed.

12.4.2 Grinding Circuit:

Describe the grinding process, including the equipment required, how the ore is conveyed between stages, any additions that are required to control pH, and the type of grinding media that will be used.

12.4.3 Flotation Circuit:

Provide a description of the flotation circuit, including the equipment required, the number of rougher and cleaner cells, the reagents that will be used and where in the process they will be added, the order in which the metals are removed, and the number of samplers that are required. Describe the circuit required for all metals that will be removed. Include schematics for each circuit.

12.4.4 Concentrate Handling:

Describe how concentrate will be transported from the metal circuits to the storage pads, including the equipment required, the solution concentration, the storage capacity of the stock tanks, the type of filter press that is used, and how overflow will be collected and recycled. Include a schematic of the concentrate handling system.

12.4.5 Tailings Disposal:

Describe how the tailings are transported from the mill to the disposal location, include details on any additions to the tailings before transport, and identify the percent water content of tailings at the time of disposal.

12.4.6 Reagent Handling and Preparation:

Provide a list of all reagents used in the milling process, where these reagents are stored, and the equipment required to store, measure, and transport these chemicals. Include process flow charts for the reagent systems.

12.5 Concentrate Production

Provide a table that outlines the daily concentrate grade, metal recoveries, and production rates for all metals produced.

12.6 Concentrate Storage and Haulage

Describe where concentrates will be stockpiled, how the concentrate is transferred into haul trucks, and the transport route for concentrate. Describe any dust control systems that are required for this process.

12.7 Power Plant

Describe the power plant facilities, the generation capacity, the capacity that it will be run at on a daily basis and any backup facilities available. Provide layout drawings, issued for construction drawings, and electrical diagrams.

13.0 Heap Leach and Process Facilities Plan

The Heap Leach and Process Facilities Plan will outline the construction, operation and shut-down of the heap leach facilities. The Plan should provide details about the design of the heap leach facility including all components, phases and processes. Designs must include plans, cross-sections, long-sections, detail figures, process charts, sequencing and other pertinent figures that illustrate how the proposed facilities will be constructed and operated. Detailed design analyses should be included as appendices.

13.1 Introduction

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

13.2 Design Criteria

Provide the design criteria that guide the heap leach facility design including project constraints, regulatory and guidance-based criteria and other criteria. These are the criteria that will define the effectiveness of the proposed design. Criteria should be described for all components of the system, recognizing that criteria may vary depending on risks associated with specific components or processes. Rationale for selection of all criteria should be provided. Where criteria are developed in accordance with regulatory requirements or guidance documents, rationales must clearly demonstrate how the proposed criteria meet these requirements or guidance. If different criteria will be applied during different project phases, these should be specified. If the criteria are based on detailed site-specific analyses (e.g., water balance and stability analyses), these should be referenced and provided. Some common types of criteria are identified below, with key reference documents noted.

Design documentation should demonstrate how the proposed design achieves the design criteria.

13.2.1 Ore Quantities:

Include overall tonnage, daily and annual loading rates, and loading season.

13.2.2 Leaching:

Provide leach solution application rates and methods, leaching areas, and leaching ore volumes

13.2.3 Geotechnical Criteria:

Describe seismic design events, factors of safety and slope angles. Include hazard classification for all dams and the rationale for the classification.

13.2.4 Hydrologic Criteria:

Describe flood design events, inflow hydrographs, erosion control, sediment removal, freeboard, flood routing capacity, and emergency or event water storage capacity.

13.2.5 Storage Criteria:

Describe the combination of events considered in storage estimates including climatic, operational and drain down events (e.g., water balance predictions of operational storage at critical times, design extreme climatic inflows and design emergency drain down).

13.2.6 Liner Criteria:

Provide permeabilities and leakage rates.

13.2.7 Water Quality Criteria:

Identify contaminants of concern and proposed water treatment, discharge and receiving water quality criteria.

13.3 Heap Leach Facilities Design and Construction

The Heap Leach and Process Facilities Plan should provide design details for all heap leach and process facilities constructed through various project phases including heap leach pads, process facilities, solution containment and conveyance facilities, water treatment facilities, and water management facilities. Designs and construction plans must account for site-specific conditions including adverse geotechnical conditions and extreme climatic events. Designs must demonstrate how the proposed facilities will meet the design criteria, and that they will be stable both during construction and in the long term. Designs must include the following information:

13.3.1 Foundation Conditions:

Provide specific descriptions of foundation conditions for each of the facilities, including supporting data and analyses, referencing information provided for descriptions of soil and bedrock.

13.3.2 Site Preparation:

Describe site clearing, stripping and grubbing and foundation preparation. Include areas to be cleared and volumes of material removed. Identify storage locations for waste materials generated from construction activities. For foundation preparation, describe how unsuitable in-situ materials such as ice-rich permafrost, soft, or weak materials will be identified and addressed.

13.3.3 Construction Quality Assurance/Quality Control:

Describe the construction quality assurance/quality control program that will be implemented to ensure that construction activities achieve expected performance for important factors like foundation preparation, permafrost identification and mitigation, soil liner placement, compaction, moisture conditioning, geomembrane or geosynthetic liner installation, over liner placement and ore loading. Also describe how the construction quality assurance/quality control program will ensure appropriate implementation of construction constraints related to climatic conditions like wet, dry and freezing conditions.

13.3.4 Stability and Settlement Analyses:

Describe the results of stability and settlement analyses for proposed facilities. These must be supported by site-specific sampling and testing of materials proposed for construction of the facilities, providing realistic and defensible material strengths and properties. Stability analyses should include consideration of effects of liner systems, leak detection systems, interlift liners, and leach solution application and storage. Evaluate factors of safety for static and seismic conditions, and consider potential effects of liquefaction of foundation, dam and/or ore materials. Consider potential effects of creep in frozen soils. Settlement analysis should consider consolidation of heap foundations under expected ore loading. Stability and settlement analysis reports should be included as appendices.

13.3.5 Construction Schedule:

Describe the construction schedule, addressing proposed construction phases, and also seasonal scheduling. Identify schedule constraints related to climatic conditions, for example, construction activities that cannot be completed in freezing conditions.

13.3.6 Heap Leach Pad, Events Ponds and Process Ponds:

Provide designs for confining embankments, containment berms and liner systems, including material and construction specifications, stability analyses, flood management and erosion control. Describe layout, sizing, locations, and construction methods for any proposed foundation drainage facilities. Describe any phasing for heap leach pad construction, including any temporary facilities and infrastructure.

13.3.7 Solution Storage Facilities:

Describe the overall solution storage capacity, demonstrating how the storage capacity achieves the storage-related design criteria. Incorporate results from water balance, prediction of extreme climatic inputs, and site-specific test work used to predict emergency drain down volumes. Provide designs that demonstrate how the solution storage capacity will be provided. For in-heap storage facilities, results of site-specific test work to confirm interstitial storage capacity should be provided.

13.3.8 Liner Systems:

Provide designs for all proposed liner systems. Liner systems include all components of proposed liners, for example: prepared surfaces, compacted soil liners, geosynthetic liners, geomembranes, leak detection systems, geonets, drainage layers, and liner protection layers. For proposed liner systems, provide rationales for the selection of the overall liner system, and for selection of individual liner components, describing how the system and components achieve the design criteria and provide suitable management of risks. Provide analysis to predict leakage through proposed liners, and describe proposed leakage thresholds and response actions. Describe how liner systems will respond to predicted foundation settlement. For each liner component, provide material and construction specifications, and describe surface preparation and the proposed placement including any construction constraints or frost protection requirements. Provide details for all liner anchoring, transitions and perforations.

13.3.9 Solution and Leakage Collection Systems:

Describe the pregnant solution and leakage collection systems for the heap leach pad, including pipe layout and sizing, material permeabilities, segregation of leaching and leak collection cells, solution recovery risers or wells and solution recovery pumping systems.

13.3.10 Solution Conveyance and Pumping Systems:

Describe pumping and piping facilities for conveying leach solution to and from the heap leach pad, including layout and sizing. Describe proposed solution distribution systems

and emitters, including any differences for different seasons or phases. Identify any requirements for heating of solution, and how this will be accomplished. Describe facilities to maintain double containment of process solutions, and for passive draining of escaped solution to appropriate storage facilities (e.g., pipe failures should automatically drain to events ponds). Consider performance in extreme cold conditions with loss of power, and plan for draining of piping systems passively to appropriate containment. Describe redundant and backup facilities for maintaining or re-establishing solution circulation in the event that primary circulation systems fail including backup or redundant power, switchgear, piping, pumping and distribution systems. Describe facilities for passive conveyance of emergency flows between solution storage facilities (i.e., from the heap leach pad to events ponds). Designs must assume that conveyance may be required in circumstances when there is no power available.

13.3.11 Ore Processing:

Describe the type of ore that will be placed on the heap, including both chemical and physical properties. Provide details on how the ore will be crushed including equipment requirements, number of stages, and final specifications for placed ore. Describe any requirements for agglomeration of ore. Include site-specific test work that supports proposed specifications and agglomeration.

13.3.12 Ore Heap:

Describe the methods proposed for conveying ore to, and loading ore on the pad. Describe equipment requirements, and how liner integrity will be protected during initial loading. Provide an ore loading sequence, showing proposed benches and slopes, which can be used for development of an operational water balance. Provide stability analyses both during loading and at full build-out. Describe ore characteristics including consolidation testing, permeability, and moisture characteristics. Describe any interlift liners including types and thicknesses of liners, rationale for use of any interlift liners, rationale for selection of liner type and stability analyses. Describe the barren solution distribution system that will be used and provide site-specific test work that demonstrates the ability of ore materials to convey solution at the proposed application rates. If interlift liners are proposed, describe how the solution distribution and collection systems would be affected.

13.3.13 Surface Water Management:

Provide designs for surface water management facilities and infrastructure (e.g., temporary diversions, permanent diversions, intercept ditches, sediment control ponds, spillways) including layout, sizing, material and construction specifications, and erosion

control. Designs should demonstrate how the facilities will route design events and minimize risks of mixing runoff water with process solutions. Operations in low flow and freezing conditions should be addressed. Designs for both permanent and temporary facilities must be included. Routing of water following failures should be addressed if it may affect heap leach process facilities, including any implications for process solution water balance and conveyance facilities. Provide designs for sediment control and removal facilities for both construction and operation phases, including retention times and removal efficiencies.

13.3.14 Metal Recovery and Processing Facilities:

Describe the processes for recovery of metal from pregnant leach solution. The process descriptions should include details of all steps from barren solution chemistry through to production of the final metal product. For gold/cyanide leach systems, provide details about adsorption, desorption and recovery, acid wash/carbon stripping, carbon regeneration, and refining. For copper/sulphuric acid leach systems, provide details about extraction, washing, stripping, and electro-winning. Include descriptions of leaching test work and provide estimates of leaching times and reagent requirements and fates, including rationale for any scale-up from lab results. Provide designs for processing facilities including flow sheets, sizing, capacities, process controls and containment systems. Also provide details about how health and safety issues have been addressed, including air quality and air handling. Describe how spills or releases of process solutions will be contained. Provide details about reagent storage and handling.

13.3.15 Water Treatment:

Describe proposed water treatment processes that will be used to achieve water quality design criteria during all phases of the project. Begin by quantifying expected contaminants of concern and inflow concentrations and volumes. Capacity requirements must consider the results from the water balance and be integrated with design of solution storage and conveyance facilities. Provide results of water treatment test programs that demonstrate expected performance of treatment systems. Provide designs for water treatment facilities including flow sheets, sizing, capacities, process controls, containment systems, reagent use and discharge conditions. Describe amounts and characteristics of any water treatment sludge and describe management plans for sludge. Provide designs for any sludge containment facilities/approaches, both temporary and permanent. Describe scheduling for construction of water treatment facilities, including any variations or additions that may be required for specific mines phases (e.g., detoxification).

13.3.16 Borrow Sources:

Provide quantities of borrow materials required for construction activities, including material specifications. Identify sources for proposed borrow materials, and provide test work to confirm that proposed sources contain sufficient quantities of materials that have suitable geotechnical and geochemical characteristics to meet construction requirements. Include results of any test work to confirm that borrow material will not have unacceptable metal leaching characteristics. Describe any material processing that will be required.

13.3.17 Access Management:

Describe measures and facilities to control and manage access to heap leach facilities by humans and wildlife (including birds) during all project phases.

13.3.18 Access Roads:

Provide details on any roads that are required to access the heap. Include detailed design drawings.

13.4 Heap Leach Facilities Operation

The Heap Leach and Process Facilities Plan should provide a detailed description of proposed heap leach operation. The design and construction of the heap leach facilities are in part defined by the operational requirements. Therefore, the design criteria can only be achieved if the facilities are operated in accordance with well-defined plans that recognize the limitations of the design, and the associated risks. To ensure a thorough understanding of operational approaches, the Heap Leach and Process Facilities Plan should include the following operational information.

13.4.1 Solution Management:

Solution management is a critical component for heap leach projects because during operation, rinsing and detoxification phases, most heap leach facilities will contain volumes of process solution that exceed the total storage capacity of all facilities on site. Robust solution management plans are critical for avoiding loss of control of the water balance that could arise from climatic events, power failures or the failure of other site infrastructure and lead to release of process solutions. Provide a solution management plan that describes how storage and water treatment facilities will be utilized during each phase and during emergency events. Provide flow sheets that illustrate where and how solution would flow, including quantities and qualities, in various operational scenarios and emergency situations. Solution management plans must incorporate results from the water balance, and consider average, wet, dry and extreme wet

conditions. They must also consider operational solution inventories and drain down quantities at any time during operations. Identify conditions (emergency or otherwise) in which each storage facility would be utilized, and the measures that will be taken to re-establish storage capacity for future events once facilities have been used. If storage capacity will be used for operational purposes (e.g., storage of freshwater for future process use), the implications of these uses on emergency storage capacity must be addressed. Solution management plans should also address management of solutions from the leak detection system, including identification of leakage thresholds and responses.

13.4.2 Operation, Maintenance and Surveillance Plan:

Provide a detailed description of proposed operations, maintenance and monitoring programs for the heap leach facility. Describe the operational requirements that will help to ensure that the heap leach facility performs in accordance with the design criteria. Provide detailed descriptions of proposed monitoring programs and infrastructure (e.g., flow monitoring equipment, slope inclinometers, survey hubs, thermistors, groundwater monitoring wells, etc.) for solution inventory, water quality, flow, physical stability, leak detection, groundwater quality/flow and climate. Describe programs for evaluating and interpreting the results of monitoring programs, and how these will be used to influence operational decisions and maintenance requirements.

13.4.3 Adaptive Management Plans:

Describe any proposed adaptive management plans that are designed to address unexpected performance of the heap leach facilities. Such plans should consider the "Type A and B Quartz Mining Undertakings, Information Package for Applicants" (Yukon Water Board, 2012), especially the position statement (Paragraph 4.2.5) that adaptive management is a process for addressing uncertainty but shall not be the basis for management of the project. To meet the intent of the "Information Package for Applicants" (Paragraph 5.11), adaptive management plans should provide: descriptions of specific events associated with uncertain performance, identification of appropriate indicators for measuring performance, detailed descriptions of monitoring requirements, definitions of specific thresholds for responding to unexpected performance, clear processes for evaluating monitoring results and comparing to thresholds, and descriptions of specific actions that will be taken in response the threshold exceedences. For a heap leach facility, adaptive management plans may often provide response plans for solution leakage that is higher than expected, for example.

13.4.4 Emergency Management:

Describe how the heap leach facilities have been designed and operations will be implemented to minimize risks associated with emergency and extreme events. Provide details about how design features and operational actions will be used to ensure environmental protection during extreme climate events (e.g., precipitation, snowmelt, and temperature), power failures, forest fires, and other events that cause loss of pumping capacity for leaching solutions.

13.5 Heap Leach Facilities Shut-down

Guidance for reclamation and closure of heap leach facilities is addressed in separate guidance documents. However, the Heap Leach and Process Facilities Plan needs to address shut-down (temporary and permanent) of heap leach facilities, including any detoxification, neutralization, rinsing, and drain down that entail unique challenges for heap leach facilities. Planning for these is integral to the construction and operation of the heap leach facilities because the cessation of ore loading during these phases can have significant effects on the water balance, and can influence sizing and capacities for treatment, storage, conveyance and pumping facilities. The Heap Leach and Process Facilities Plan should include the following information related to shut-down.

13.5.1 Rinsing, Detoxification and Neutralization:

Describe proposed processes and sequences for any residual leaching, rinsing, detoxification and/or neutralization of heap materials. The proposed processes should be supported by site-specific test work that demonstrates the effectiveness of proposed rinsing, detoxification and neutralization methods. Describe the results of test work to demonstrate the hydrodynamic performance of ore materials under expected loads and through successive leach cycles, providing evidence that rinsing will be physically practical. Provide estimates of water use, volumes, and durations for rinse, detoxification and neutralization activities. Quantify water treatment requirements based on water balance results, and describe water quality suitable for rinsing activities, including sources of proposed water. Identify water quality criteria that will be used to start and end rinsing, detoxification and/or neutralization activities

13.5.2 Drain Down:

Describe the sequence and plan for final drain down of the heap leach facility, considering the total quantity of solution, expected drain down rate, and the capacity of proposed water treatment systems.

13.5.3 Water Balance and Solution Management:

Describe how rinsing, detoxification, neutralization and drain down have been incorporated into the water balance and solution management plan.

13.5.4 Covers:

Describe the types of cover that will be used to reclaim the surface of any heap leach facility. Provide designs supported by site-specific data and analysis to demonstrate the expected performance of covers for controlling contaminant migration into the aquatic and terrestrial environment. Performance of covers should be incorporated into water balance and water quality modeling, to predict long-term contaminant effects.

13.5.5 Temporary Shut-down:

Describe what activities would be undertaken during a temporary shut-down of mining operations, including plans for continued pumping or treatment and drain down of solutions.

14.0 Tailings Management Plan

A Tailings Management Plan describes the management methods for tailings on site. This includes tailings impoundments, dry stack facilities, in-pit tailings deposition or other tailings disposal methods. Underground disposal of tailings is not addressed in this guidance document because it is specifically addressed in guidance documents related to underground developments. The Tailings Management Plan will provide details about the design, construction and operation of tailings disposal facilities. It will also address closure of the facilities in sufficient detail to identify how closure requirements may influence design, construction and operation. Designs must include plans, cross-sections, long-sections, detail figures, process charts, deposition plans and other pertinent figures that illustrate how the proposed facilities will be constructed and operated. Detailed design analyses should be included as appendices.

The Tailings Management Plan will consist of the generic information about the site conditions and water management strategies along with more detailed information tailored to the specific facility design.

Suggested Appendices: Material Data Safety Sheets, Spill Response Plan

14.1 Introduction

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

14.2 Design Criteria

Provide the design criteria that guide the design for the tailings management facilities including project constraints, regulatory and guidance-based criteria and other criteria. These are the criteria that will define the success of the proposed design. Criteria should be described for all components of the system, recognizing that criteria may vary depending on risks associated with specific components or processes. Rationale for selection of all criteria should be provided. Where criteria are developed in accordance with regulatory requirements or guidance documents, rationales must clearly demonstrate how the proposed criteria meet these requirements or guidance. If different criteria will be applied during different project phases, these should be specified. If the criteria are based on detailed site-specific analyses (e.g., stability analyses), these should be referenced and provided. The following design criteria must be defined. Additional criteria may be required depending on the tailings facility on site

and the results of an environmental assessment. Design documentation should demonstrate how the proposed design achieves the design criteria.

14.2.1 Tailings Quantities:

Provide the overall tonnage, the daily and the annual deposition rates.

14.2.2 Tailings Properties:

Provide the tailings densities, consolidation rates and permeability.

14.2.3 Geotechnical Criteria:

Provide the seismic design events, factors of safety, slope angles, material strengths, seepage rates. Include hazard classification for all dams and the rationale for the classification.

14.2.3 Hydrologic Criteria:

Provide flood design events, inflow hydrographs, erosion control, sediment removal, freeboard, flood routing capacity, emergency water storage capacity.

14.2.4 Tailings Storage Conditions:

Identify any constraints on tailings storage; e.g., saturated, unsaturated, etc.

14.2.5 Liner Criteria:

Provide the permeabilities and leakage rates.

14.2.6 Water Quality Criteria:

Identify contaminants of concern and proposed water treatment, discharge and receiving water quality criteria.

14.3 Tailings Management Facilities Design and Construction

The Tailings Management Plan should provide design details for all facilities related to tailings storage and management. This should include facilities constructed through various project phases including tailings dams, tailings handling facilities and equipment, contaminated water management facilities, water treatment facilities and surface water management facilities. Designs and construction plans must account for site-specific conditions including adverse geotechnical conditions and extreme climatic events. Designs must demonstrate how the proposed facilities will meet the design criteria, and that they will be stable both during construction and in the long term. Designs must include the following information.

14.3.1 General Requirements:

The following information requirements apply, as appropriate, to all types of tailings storage facilities:

14.3.1.1 Foundation Conditions

Provide specific descriptions of foundation conditions for all facilities. As appendices, include supporting data and analyses, referencing information provided for descriptions of soil and bedrock.

14.3.1.2 Site Preparation

Describe site clearing, stripping and grubbing and foundation preparation. Include areas to be cleared and volumes of material removed. Identify storage locations for waste materials generated from construction activities. For foundation preparation, describe how unsuitable in-situ materials, such as ice-rich permafrost, soft or weak materials, will be identified and addressed.

14.3.1.3 Construction Quality Assurance/Quality Control

Describe the construction quality assurance/quality control program that will be implemented to ensure that construction activities achieve expected performance for important factors like foundation preparation, permafrost identification and mitigation, dam construction, liner placement, compaction, moisture conditioning and tailings deposition. Also describe how the construction quality assurance/quality control program will ensure appropriate implementation of construction constraints in adverse climatic conditions like wet, dry and freezing conditions.

14.3.1.4 Stability and Settlement Analyses

Describe the results of stability and settlement analyses for proposed facilities. These must be supported by site-specific sampling and testing of materials present in foundations and/or proposed for construction of the facilities, providing material strengths and properties. Stability and settlement analysis reports should be included as appendices.

14.3.1.5 Construction Schedules

Describe construction schedules, addressing proposed construction phases, and also seasonal scheduling. Describe annual construction plans including scheduling and sequencing of tailings disposal areas. Identify schedule constraints related to climatic conditions, for example, construction activities that cannot be completed in freezing conditions.

14.3.1.6 Surface Water Management

Provide designs for surface water management facilities and infrastructure (e.g., temporary diversions, permanent diversions, intercept ditches, sediment control ponds, spillways) including layout, sizing, material and construction specifications and erosion control. Designs should demonstrate how the facilities will route design events and minimize risks of mixing runoff water with tailings water. Operations in low flow and freezing conditions should be addressed. Designs for both permanent and temporary facilities must be included. Provide designs for sediment control and removal facilities for both construction and operation phases, including retention times and removal efficiencies. Describe how the facilities are designed to address closure requirements.

14.3.1.7 Liner Systems

Provide designs for all proposed liner systems. Liner systems include all components of proposed liners, for example: prepared surfaces; compacted soil liners; geosynthetic clay liners; geomembranes; geonets; drainage layers; and liner protection layers. For proposed liner systems, provide rationales for the selection of the overall liner system, and for selection of individual liner components, describing how the system and components achieve the design criteria and provide suitable management of risks. Provide analysis to predict leakage through proposed liners and describe how water that accumulates above the liner will be managed. Describe how liner systems will respond to predicted foundation settlement. For each liner component, provide material and construction specifications, and describe surface preparation and the proposed placement including any construction constraints or frost protection requirements. Provide details for all liner anchoring, transitions and perforations.

14.3.1.8 Borrow Sources

Provide quantities of borrow materials (e.g., dam fill, seepage control material, filter material, rip-rap, soil liner material, drainage materials) required for construction activities, including material specifications. Identify sources for proposed borrow materials, and provide test work to confirm that proposed sources have suitable quality and quantity to meet construction requirements. Include results of any test work to confirm that borrow material will not have unacceptable metal leaching characteristics. Describe any material processing that will be required.

14.3.1.9 Soil Storage

Describe temporary and permanent storage facilities for soil and other construction related materials (e.g., organics). Provide designs for storage facilities including foundation descriptions, site preparation, water management, erosion control and stability analysis. Describe any specific requirements for addressing storage of ice-rich or high moisture materials.

14.3.1.10 Access Management

Describe measures and facilities to control and manage access to tailings storage facilities by humans and wildlife (including birds) during all project phases.

14.3.2 Slurry Tailings Impoundments:

Slurry tailings impoundments include any facilities where all or a portion of the tailings will be retained by constructed dams where the phreatic surfaces may be within the tailings or the dam. Most commonly, this will include facilities that deposit slurry tailings or thickened tailings. In addition to the relevant general requirements, the following information requirements should be addressed, as appropriate, for these tailings impoundments.

14.3.2.1 Tailings dams

Provide a detailed description of the location, size and orientation of any tailings dam. Describe material and construction specifications, foundation preparation, seepage control, grouting, spillways, flood management and erosion control. Describe any phasing for tailings dam construction, including any temporary facilities and infrastructure (e.g., temporary diversions, coffer dams). Include detailed design drawings of the dam and associated infrastructure.

14.3.2.2 Stability analysis

Provide a detailed stability analysis for tailings dams and tailings, evaluating factors of safety for static and seismic conditions, and considering potential effects of liquefaction of foundation, dam and/or tailings materials. Consider potential effects of creep in frozen soils.

14.3.2.3 Seepage analysis

Describe expected seepage through and around any tailings dam, and into underlying aquifers. Describe design and operation measures intended to control or manage seepage flows, including seepage control zones and filters, grouting, drains, seepage collection ponds/dams and collection/piping systems. Identify how seepage water would be managed.

14.3.2.4 Water covers

Describe how the tailings facilities have been designed to address requirements for water covers. Discuss maintenance of water covers both during tailings placement and in the long term. Describe any requirements for co-disposal of tailings and waste rock, and how such disposal will be conducted. Provide evidence through seepage and water balance analyses about uncertainty related to long-term maintenance of water covers in various climate scenarios.

14.3.2.5 Dam break assessment

Provide details on a dam break assessment. Include the peak flood outflow, peak discharge, the amount of tailings expected to escape and an estimate of downstream flows that would result from a dam breach. Describe the potential consequences of a dam breach for human and wildlife populations, loss of life, environment, cultural effects, infrastructure and economics.

14.3.2.6 Storage Capacity

Using the results of the water balance analysis, demonstrate how the proposed tailings management facility will provide required storage requirements for the life of the mine. Include operational volumes, flood capacity requirements and the amount of freeboard required.

14.3.2.7 Flood Management

Provide a detailed description of the hydraulic design parameters for all spillways, including design flood sections, inflow hydrographs, flood routing, freeboard for all dam stages and the effect of snowmelt. Describe how flood routing would integrate with seepage collection facilities. Describe how the design addresses potential climate change scenarios.

14.3.2.8 Tailings consolidation

Describe the expected consolidation and/or draining of tailings solids, and any design measures intended to assist these processes.

14.3.3 Sub-Aerial Tailings Storage:

Sub-aerial tailings storage facilities include those facilities where tailings will be stored in a drained state, and where the phreatic surface is below the tailings and any retaining embankments. Dry-stack tailings storage facilities are usually designed as sub-aerial storage facilities. In addition to the relevant general requirements, the following information requirements should be addressed, as appropriate, for these sub-aerial storage facilities.

14.3.3.1 Tailings stacks and retaining embankments

Provide a detailed description of the location, size and orientation of the tailings stack and any retaining embankments. Describe material and construction specifications, foundation preparation, drainage control, drainage layers, finger drains, surface water management and erosion control. Describe any phasing for embankment or stack construction, including any temporary facilities and infrastructure. Describe design requirements for the tailings stack including material composition, lift thickness, compaction requirements and percent solids content. Include detailed design drawings of the proposed stack and associated infrastructure.

14.3.3.2 Stability analysis

Provide a detailed stability analysis for the tailings stack and embankment, evaluating factors of safety for static and seismic conditions, and considering potential effects of liquefaction of foundation, embankment or tailings materials. Consider potential effects of creep in frozen soils.

14.3.3.3 Thermal Analysis

Describe the results of any thermal analysis conducted to predict performance of the foundation, tailings stack and embankment. Provide details on how thermal analyses were undertaken, the assumptions that were used, how long-term climate data was incorporated and if climate change predictions were taken into account. Describe the long-term impact the facility will have on the natural thermal regime, and when any ice or frozen overburden is expected to thaw. Describe how thaw consolidation was considered in the design, including how pore water pressure will affect the stability of the stack and if a drainage blanket or alternate measures will be required to ensure thaw consolidation does not affect drainage.

14.3.3.4 Drainage and seepage facilities

Describe how the proposed design will maintain continued and long-term drainage of tailings material and how it will address seepage. Describe how the design will address up-gradient runoff, incident precipitation, tailings porewater and groundwater. Describe the expected quality of drainage water and how that water will be managed through all project phases. Provide design details for drainage facilities including drainage blankets, finger drains, drainage wells, etc. Also provide design details for seepage collection and pumping facilities, considering both low and high flows and operation in freezing conditions.

14.3.3.5 Tailings consolidation

Describe the expected consolidation of tailings solids, and any design measures intended to assist consolidation.

14.3.4 In-Pit Tailings Storage:

In-pit tailings storage facilities include those facilities where tailings will be contained within mined-out open pits, below the natural spill elevation of the pit. Where tailings will be stored above the natural spill elevation, requirements for slurry or sub-aerial tailings storage will also need to be considered, as appropriate. In addition to the relevant general requirements, the following information requirements should be addressed, as appropriate, for in-pit storage facilities.

14.3.4.1 Storage capacity and spill elevations

Provide the storage capacity of each pit where tailings will be stored, include any constraints (i.e., topography, stability, composition) that limit the storage capacity. Include diagrams and graphs to show the storage volume related to the pit elevation.

14.3.4.2 Tailings density

Provide the density that storage capacity calculations are based on, and the rationale for choosing that density. Provide a sensitivity analysis which shows how storage volumes are affected by different densities of tailings. Describe mitigative measures that would be applied if the actual tailings densities result in insufficient storage space.

14.3.4.3 Surface water management

Describe how water will be managed around pits containing tailings, if the water will be diverted around or allowed to drain into the pit and how high flow events will be managed. Describe whether pits will serve for emergency water storage purposes, and if so, how much unused pit capacity will be maintained in pits to ensure there is sufficient surge capacity to respond to high flow events. Provide a rationale for the surge capacity chosen using average, wet and dry flow events and the site wide water balance.

14.3.4.4 Tailings deposition

Describe how tailings will be transported from the mill to the pit, the diameter of line or size of slurry tanks, approximate temperature of tailings, if heat tracing will be installed and the length and gradient of the line. Describe shut-down procedures should the mill stop operating. Provide a map showing the discharge locations. Describe the tailings deposition method: e.g., subaqueous, spray, piped. Describe how the line (if any) can be extended and shortened as required, and the expected beach angle.

14.4 Tailings Management Facilities Operation

The Tailings Management Plan should provide a detailed description of proposed tailings management operations. The design and construction of the tailings storage facilities is in part defined by the operational requirements. Therefore, the design criteria can only be achieved if the facilities are operated in accordance with well-defined plans that recognize the limitations of the design, and the associated risks. To ensure a thorough understanding of operational approaches, the Tailings Management Plan should include the following operational information.

14.4.1 Operation, Maintenance and Surveillance:

Provide a detailed description of proposed operations, maintenance and monitoring programs for the tailings management facilities. Provide detailed descriptions of proposed monitoring programs and infrastructure (e.g., flow monitoring equipment, slope inclinometers, survey hubs, thermistors, etc.) for physical stability, water quality, flow and climate. Describe programs for evaluating, interpreting and reporting the results of monitoring programs and how these will be used to influence operational decisions and maintenance requirements.

14.4.2 Tailings Deposition Strategy:

Describe the tailings placement strategy. For slurry tailings disposal, describe spigot locations, length of time a spigot will remain in a particular location and the slope and direction of the beach that will form. For thickened or de-watered tailings disposal, describe moisture and/or density specifications for tailings deposition, lift thickness, deposition slopes and compaction requirements and how these requirements will be achieved. Describe how the deposition strategy will help to achieve the design criteria.

14.4.3 Off-Spec Tailings Disposal:

Describe specifications that will be applied to determine suitability of tailings for placement in certain storage facilities (e.g., moisture content for placement in dry-stack facilities). Describe how tailings materials that do not meet specifications for placement will be handled including designs for any temporary or permanent storage locations.

14.4.4 Water Recycle:

Describe approaches for water recycle for milling purposes, any facilities for water recycle, and any constraints to use of water recycle.

14.4.5 Air Quality and Dust Control:

Describe how the proposed tailings operations and facilities are expected to affect air quality, including potential dust transmission. Describe measures that will be taken to minimize and control dust.

14.4.6 Emergency Management:

Describe how the tailings management facilities have been designed and operations will be implemented to minimize risks associated with emergency and extreme events. Provide details about how design features and operational actions will be used to ensure environmental protection during extreme climate events (e.g., precipitation,

snowmelt, and temperature), power failures, forest fires and other events that may lead to mill shut-down.

14.4.7 Adaptive Management Plans:

Describe any proposed adaptive management plans that are designed to address unexpected performance of tailings management facilities and operations. The adaptive management plans should provide: (i) descriptions of specific events associated with uncertain performance, (ii) identification of appropriate indicators for measuring performance, (iii) detailed descriptions of monitoring requirements, (iv) definitions of specific thresholds for responding to unexpected performance, (v) clear processes for evaluating monitoring results and comparing to thresholds, and (vi) descriptions of specific actions that will be taken in response the threshold exceedences.

15.0 Waste Rock and Overburden Management Plan

A Waste Rock and Overburden Management Plan will describe the types of overburden and rock that will be encountered on site and how these materials will be characterized, segregated, and stored to ensure long-term chemical and physical stability of the site. The plan will provide details about the design, construction and operation of all waste rock and overburden storage facilities. It will also address closure of the facilities in sufficient detail to identify how closure requirements may influence design, construction and operation. Underground disposal of waste rock is not addressed in this guidance document because it is specifically addressed in guidance documents related to underground developments.

15.1 Introduction

Provide an overview of the design for all rock and overburden storage facilities, including facilities for waste rock, overburden, ore and low-grade ore. Also describe the associated water management infrastructure and the proposed operational plan for handling and storing rock and overburden materials. Describe the timing and sequencing for each proposed facility.

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

15.2 Design Criteria

Outline the design criteria that were used to guide the design for the waste management facilities including project constraints, regulatory and guidance-based criteria and other criteria. Criteria should be described for all waste management and storage components, recognizing that criteria may vary depending on risks associated with specific facilities. Rationale for selection of all criteria should be provided. Where criteria are developed in accordance with regulatory requirements or guidance documents, rationales must clearly demonstrate how the proposed criteria meet these requirements or guidance. If different criteria will be applied during different project phases, these should be specified. If the criteria are based on detailed site-specific analyses (e.g., stability analyses), these should be referenced and provided. Design documentation should demonstrate how the proposed design achieves the design criteria.

15.2.1 Rock and Overburden Quantities:

Provide the overall tonnage, daily and annual deposition rates for each type of material.

15.2.2 Materials Properties:

Provide the densities, moisture and drainage characteristics, strengths, and other geotechnical properties for each type of material.

15.2.3 Geotechnical Criteria:

Based on the Mined Rock and Overburden Piles Investigation and Design Manual Interim Guidelines provide the general criteria that will be used for each dump constructed on site. Describe seismic design events, factors of safety, slope angles, material strengths, seepage rates.

15.2.4 Hydrologic Criteria:

Provide flood design events, inflow hydrographs, erosion control, sediment removal.

15.2.5 Material Storage Conditions:

Describe any constraints on rock or overburden storage; e.g., under water storage, thaw unstable materials.

15.2.6 Liner Criteria:

Provide permeabilities and leakage rates.

15.2.7 Water Quality Criteria:

Identify contaminants of concern and proposed water treatment, discharge and receiving water quality criteria.

15.3 Storage Facility Design

Provide specific designs for each dump that will be operated on site. This should include all rock and overburden storage facilities constructed through various project phases including both temporary and permanent storage facilities. It should also include all facilities for water management including both contaminated and non-contact water. Designs and construction plans must account for site-specific conditions including adverse geotechnical conditions and extreme climatic events. Designs must demonstrate how the proposed facilities will meet the design criteria, and that they will be stable both during construction and in the long term. Each dump must include the information outlined below.

15.3.1 Foundation Conditions:

Describe any geotechnical conditions at the dump site that warrant specific design considerations, and provide any assumptions that were used when designing the dump. Identify foundation conditions with logs of vertical sections that show the locations of drill holes, material sizing, material type, and permafrost. Include a stability analysis with a factor of safety based on earthquake scenarios.

15.3.2 Design Details:

Describe in detail the construction of the dump, the materials that will be used to create drainage systems below the dump, any liners that will be place, whether a toe berm is required, any specific material sorting procedures, and any water diversion structures that are required. Include lift heights, bench widths, internal and overall slopes, and specific measures to address site or material conditions. Describe material and construction specifications. Provide design drawings showing the cross-section of the dump from side-to-side and front-to-back in several locations, include any water diversion structures that will be constructed around or on the dumps. These drawings must be stamped by an engineer licensed to practice in the Yukon.

15.3.3 Co-Disposal:

Describe any proposed co-disposal of waste rock with tailings materials. Details of co-disposal should be addressed in a Tailings Management Plan.

15.3.4 Clearing, Stripping and Grubbing:

Describe any clearing, stripping and grubbing activities that are required to prepare the dump locations. Include the area to be cleared, and where materials will be stored including foundation descriptions, site preparation, water management, erosion control and stability analysis. Describe any specific requirements for addressing storage of ice-rich or high moisture materials.

15.3.5 Transport and Disposal:

Describe how materials will be transported, unloaded and distributed on the waste dumps. Describe how lifts will be built up, if grading is necessary, and how the final dump lift will be constructed.

15.3.6 Stability and Settlement Analyses:

Provide stability analyses for proposed facilities. These must be supported by site-specific sampling and testing of materials present in foundations and the stored materials, providing realistic and defensible material strengths and properties.

15.3.7 Construction Quality Assurance/Quality Control:

Describe the construction quality assurance/quality control program that will be implemented to ensure that construction activities achieve expected performance for important factors like foundation preparation, permafrost identification and mitigation, dump construction, liner placement, and compaction. Also describe how the construction quality assurance/quality control program will ensure appropriate implementation of construction constraints related to climatic conditions like wet, dry and freezing conditions.

15.3.8 Surface Water Management:

Provide designs for surface water management facilities and infrastructure (e.g., temporary diversions, permanent diversions, intercept ditches, sediment control ponds) including hydraulic analyses, layout, sizing, material and construction specifications, and erosion control. Designs should demonstrate how the facilities will route design events and effectively manage segregation of non-contact water from contact water. Operations in low flow and freezing conditions should be addressed. Designs for both permanent and temporary facilities must be included. Provide designs for sediment control and removal facilities for both construction and operation phases, including retention times and removal efficiencies.

15.3.9 Liner Systems:

Provide designs for all proposed liner systems. Liner systems include all components of proposed liners, for example: prepared surfaces, compacted soil liners, geosynthetic clay liners, geomembranes, geonets, drainage layers, and liner protection layers. For proposed liner systems, provide rationales for the selection of the overall liner system, and for selection of individual liner components, describing how the system and components achieve the design criteria and provide suitable management of risks. Provide analysis to predict leakage through proposed liners and describe how water that accumulates above the liner will be managed. Describe how liner systems will respond to predicted foundation settlement and to expected loading. For each liner component, provide material and construction specifications, and describe surface preparation and the proposed placement, including any construction constraints or frost protection requirements. Provide details for all liner anchoring, transitions and perforations.

15.3.10 Waste Generation and Disposal Operations

The Waste Rock and Overburden Management Plan should provide a detailed description of proposed operational plans for handling, storage and surveillance of all

rock and overburden materials at the site. The design and construction of the rock and overburden storage facilities are in part defined by the operational requirements. To ensure a thorough understanding of operational approaches, the Waste Rock and Overburden Management Plan should include the following operational information.

15.3.10.1 Operation, Maintenance and Surveillance Plan:

Provide a detailed description of proposed operations, maintenance and monitoring programs for rock and overburden management. The description of operations should address the components described below, along with any additional operational requirements that will help to ensure that the rock and overburden management facilities and operations perform in accordance with the design criteria. Provide detailed descriptions of proposed monitoring programs and infrastructure (e.g., slope inclinometers, survey hubs, thermistors, etc.) for water quality, flow, physical stability, and climate. Describe programs for evaluating and interpreting the results of monitoring programs, and how these will be used to influence operational decisions and maintenance requirements.

15.3.10.2 Types of Waste

Describe the different types of rock and overburden (ore, waste rock, overburden, low-grade ore) that will be excavated throughout the duration of the project, their geochemical make-up and whether acid rock drainage or metal leaching is expected from the different rock types.

15.3.10.3 Waste Characterization Protocol

Provide detailed sampling programs for characterizing rock and overburden during operations, including how materials will be tested to meet requirements of segregation protocols (e.g., acid generation or metal leaching potential, or the suitability for reclamation purposes). Provide the testing protocols, including how often drill cuttings are sent for assay, what tests are completed on site, and how the assay results are used to lay out field polygons.

15.3.10.4 Waste Segregation Protocol

Describe criteria, protocols and operational procedures for segregation of rock and overburden materials. Specify criteria that will be used to segregate waste on the basis of chemical or geotechnical properties. Describe the waste segregation protocol that will be followed to ensure potentially acid generating or metal leaching materials are kept separate from more chemically stable materials, and how materials placed in dumps will meet geotechnical design specifications (e.g., thaw stable, liquefaction potential). Describe the locations where overburden and reclamation materials will be stored and how these materials will be kept separate from waste rock not suitable for reclamation purposes.

15.3.10.5 Waste Volumes

Provide the volume estimates for each rock and overburden type; provide both bank cubic meter and cubic meter estimates.

15.3.10.6 Waste Disposal Schedule

Provide an estimate of the volumes of rock and overburden that will go into each dump, and the timeframe in which these dumps will be used.

15.3.10.6 Monitoring Program

Describe the monitoring program to monitor movement and stability of the waste dumps as well as water quality and flow conditions. Provide details that include monitoring frequency and locations and describe how the monitoring data will be evaluated, interpreted and reported.

15.3.11 Adaptive Management Plans:

Describe any proposed adaptive management plans that are designed to address unexpected performance of rock and overburden management programs. Adaptive management plans should provide: descriptions of specific events associated with uncertain performance, identification of appropriate indicators for measuring performance, detailed descriptions of monitoring requirements, definitions of specific thresholds for responding to unexpected performance, clear processes for evaluating monitoring results and comparing to thresholds, and descriptions of specific actions that will be taken in response the threshold exceedences.

16.0 Road Construction Plan

A Road Construction Plan is required when a new road is being constructed to access a mine site; this plan is not required for upgrading existing roads and trails. This plan will detail the construction plans for the road, outline the operating protocols, and describe the closure plan for the road.

Suggested Appendices: Geotechnical Evaluations, Geochemical Evaluations

16.1 Introduction

Provide a table of concordance that outlines all applicable proponent commitments made during the environmental assessment the decision document terms and conditions and license conditions, and show how these terms have been addressed in this plan.

For all revisions to this plan provide a table which indicates all areas where changes have been made.

16.2 Site Preparation

Provide a description of any clearing activities that are required to prepare the road corridor. Include a description of the area to be cleared and where organic materials will be stored.

Provide a description of the stripping and grubbing activities that are required. Include the total area and volume of material that will be removed and where the material will be stored.

16.3 Road Design and Specifications

Provide the design standards that will be used for road construction including the number of lanes, gradient, culvert diameters, clearings on either side of the road, side slopes and back slopes, ditch depth, and any areas that require safety berms.

16.3.1 Access Tie-in and Staging Areas:

Provide the location where the new road will intersect an existing road, where the staging areas will be located, outline what will be stored at the staging areas, and provide detail on any fencing or gating that will be required.

16.3.2 Access Control:

Describe all access control measures that will be employed during mine construction, operation, and closure. Describe in each section how highway vehicle, all-terrain vehicle

and snowmobile usage will be controlled on the access road. Provide details on any gate, staffed or unstaffed, that will be installed on the site.

Describe the types of vehicles that will be permitted to travel on the road, and if the road will be strictly for mine personnel use. Include any precautions that will be taken to limit access during temporary closure. Describe when in the closure period the road will be decommissioned.

16.4 Borrow sources

Describe in detail all borrow sources that will be used for road construction. Outline the gross area, net area, and average depth of each source; include the volume of material, granular surfacing, and concrete aggregate for each borrow area. Describe how each area will be excavated, how material will be handled, and the testing protocols in place to determine if there is acid drainage or metal leaching concerns that need to be mitigated.

16.5 Geochemical Evaluation

Describe in detail the geochemical testing program that was used to determine the ARD/ML potential of the road construction site and any borrow sources. Provide the sampling protocol that was followed, and include the field observations for each test site. Provide the interpretation of the geochemical results and any recommendations that came as a result of the study.

16.6 Geotechnical Testing

Describe in detail the geotechnical testing that was used to determine the road location.

16.7 Best Management Practices

Describe the best management practices that will be followed to ensure the road construction has minimal impact on the environment

16.7.1 Sediment and Erosion Control:

Describe the sediment and erosion control measures that will be implemented to minimize effects to the environment and ensure stabilization of the road. Describe the measures in place to minimize runoff. Describe any design considerations that have been used to ensure peak floods will be managed as well. Include a description of all dust control measures that will be employed to ensure worker health and safety and minimize effects on the environment.

16.7.2 Site Isolation:

Provide the measures that will be employed to ensure sensitive habitats are protected while construction is taking place. Describe the site isolation techniques for instream diversions, diversion berms or dikes, swales, by-pass pipes, and coffer dams.

16.7.3 Culvert Installation & Instream Works:

Describe all protocols that will be followed to ensure that culvert installation has minimal impact to fish and the environment. Outline the instream construction windows for each stream crossing and how construction will be scheduled to operate within these periods.

Other Reports and Plans

17.0 Emergency Response & Health and Safety Plan

The Emergency Response & Health and Safety Plan is intended to describe the response measures that will be taken if an emergency, injury or accident occurs at the mine site. This plan will detail all the protocols that will be followed and the duties that each supervisor, safety professional and individual employee is responsible for.

The Emergency Response Plan will be reviewed for completeness by the Yukon Workers' Compensation Health and Safety Board. More information on the *Occupational Health and Safety Act* can be found at:

- http://www.gov.yk.ca/legislation/acts/ochesa.pdf
- Basics of a Mine Emergency Response Plan, December 16 2011. Available from the WCB offices.

Suggested Appendices: Underground Duty Cards, Emergency Contact List

PART I: EMERGENCY RESPONSE PLAN

17.1 Emergency Response Plan Purpose

Summarize the primary safety responsibilities for the site.

17.2 Definitions

Provide definitions for all terms used in this plan.

17.3 Mine Rescue Equipment

Provide a list of all the rescue equipment available on site.

17.4 Mine Rescue Team

Provide the minimum qualifications that will be required of all personnel on the mine rescue team, the certification requirements, and the frequency with which training will be updated.

17.5 Backup Mine Rescue

Describe the backup mine rescue procedure, include alternate sources of equipment and personnel that can be sourced from nearby mine sites.

17.6 Emergency Telephone Contacts

Include a comprehensive list of emergency rescue contacts. Include mine personnel, corporate personnel; First Nation contacts; Yukon government contacts; Federal government contacts; and regional fire, hospital, nursing station, and police contacts.

17.7 Emergency Action Plan Procedures

Provide a procedural flow chart for the initial response to an incident and a flow chart for the follow up to an incident.

Outline the procedures to be followed should there be a fire, major power outage, outbreak of a communicable disease, an emergency at the airstrip, or if a person becomes lost on site. Include muster station locations and which staff report to these muster areas. Outline the procedures to be followed each respective incident. Describe the activities on site that will be stopped when staff are responding to emergencies, and when these activities will be resumed after responding to an incident.

17.8 Underground Emergency Action Plan

Provide an underground design figure that shows the portal, underground workings, ventilation intakes, and emergency egress routes.

17.8.1 Underground Injury Emergencies

Outline the procedures to be followed if an injured person is discovered in the underground workings.

17.8.2 Underground Fire Procedure

Outline the procedures to be followed if a fire is discovered in the underground workings.

17.8.3 Stench Gas Release

Describe the situations in which stench gas will be released, who is responsible for its release, and the procedures to be followed after its release.

17.8.4 Refuge Station Procedure

Outline the procedures to be taken in a refuge station, how the station will be contacted, procedures in event of a fire including when fire clay should be used, what should be done when the compressed air goes off and how to operate reserve oxygen bottles.

PART II: HEALTH AND SAFETY POLICIES AND PROCEDURES

17.9 Return to Work Program

Describe the return to work program that will be used and outline the situations in which this program will be initiated. Provide the procedures that will be followed when developing this plan, include how the Yukon Workers Compensation Health and Safety

Board will be involved in the process, how the worker will be involved in the process, and follow-up of the program will be conducted.

17.10 Transportation and Med-Evac Guidelines

Provide the medical emergency evacuation protocols that will be followed on site for all classes of emergencies. Include a flow chart that shows the procedures for urgent and non-urgent ground transportation medical evacuations.

17.10.1 Med-Evac Classification

17.10.1.1 Immediate Response

Provide the medical evacuation procedures that will be followed for patients that require immediate attention. Include a list of the available equipment to respond to these situations.

17.10.1.2 Urgent or Non-Urgent Response

Describe the procedures for patients who require urgent and non-urgent attention. Include the site capability for responding to these situations and when medical evacuation will be required.

17.10.2 Site or Camp Evacuation

Provide the procedures that will be followed if a partial or total camp evacuation is required and the methods of transportation that are available for large volume evacuations.

17.10.3 Workplace Fatality

Outline the procedures that will be followed if there is a workplace fatality.

18.0 Heritage Resources Protection Plan

The Heritage and Cultural Resources Protection Plan should outline the policies and procedures that are in place for identifying, reporting and protecting historic resources and cultural values.

Heritage resources in Yukon are protected under the *Historic Resources Act*. The *Historic Resources Act* requires that the discovery of archaeological, paleontological or historic objects and burial sites be reported. Further information on the *Historic Resources Act* and best management practices can be found at:

- http://www.gov.yk.ca/legislation/acts/hire.pdf
- http://www.tc.gov.yk.ca/heritage_resources.html
- http://www.tc.gov.yk.ca/pdf/Mineral_Exploration_BMP_for_Heritage_Resources.pdf
- http://www.tc.gov.yk.ca/pdf/respecting_guidelines_her_1999_08.pdf

To assist in preparation of a Heritage and Cultural Resources Protection Plan for a project, proponents are encouraged to contact Yukon Government Heritage Resources to obtain information about known heritage resources in the project area and guidance on heritage resource protection planning.

First Nation cultural values and resources are addressed in the *Umbrella Final Agreement* and individual First Nation final agreements. Proponents are encouraged to contact the affected First Nation(s) to obtain information about areas of cultural importance traditional knowledge, and other First Nation heritage resources to inform the preparation of a comprehensive Heritage and Cultural Resources Protection Plan.

Suggested Appendices: Heritage Resoucre Assessments Completed to date

PART I: HERITAGE RESOURCES

18.1 Introduction and Purpose

Provide a general overview of the project description and location. Identify any areas of concern for heritage resources, and how this plan will address the protection of these resources.

18.2 Heritage Resource Protection Policy

Provide the company's policy on heritage resources and describe how the policy in combination with this plan will inform and guide staff and contractor decisions relating to heritage resources.

18.3 Heritage Resource Assessments

18.3.1 Heritage Resource Overview Assessment:

Provide an overview of any desktop exercises that were completed to identify landscape features or locations in the project that are likely to be associated with heritage resources.

18.3.2 Heritage Resource Inventory:

Provide an overview of any field assessments that were carried out to identify heritage resources in the project area.

18.3.3 Heritage Resource Impact Assessment:

Provide an overview of any impact assessments that were undertaken on site. Include any mitigative actions that were suggested to protect any known heritage resources in the project area.

18.4 Heritage Resource Protection Plan

Describe the procedures that will be taken to protect known heritage resources on the property.

18.5 Heritage Resource Field Guidelines

Outline the actions that will be followed should a new heritage resource be encountered in the project area.

18.6 Reporting Requirements

Outline the reporting structure that is in place for the reporting of heritage resources that were not located during previous assessments. This should include the internal and external reporting structures, and how the documents are kept confidential.

18.7 Heritage Resource Contact List

Provide the contact information for all people who will be involved in the reporting structure for heritage resources. This will include all appropriate company personnel, First Nations, Yukon Government and RCMP contacts.

18.8 Employee and Contractor Awareness and Training

Describe the training that will be given to all employees and contractors regarding the protection of known and newly identified heritage resources. Identify the frequency which this training is updated.

PART II: TRADITIONAL KNOWLEDGE

18.9 Traditional Knowledge Reports

Provide an overview of all assessments that have been undertaken to assess cultural impacts that the mining operations will have on the project area. Describe any areas of concern that were identified in these studies.

18.10 Traditional Knowledge Protocol

Describe the policy for protection of traditional knowledge and involvement of First Nation(s) in assessing impacts for future project activities

18.11 First Nation Involvement

Describe the involvement of the affected First Nations in the development of this plan, amendments to this plan, and the notification that will take place when historic resources are found

18.12 Reporting Requirements

Outline the reporting structure that is in place for the reporting of heritage resources to the affected First Nation(s)